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Efficiency of the Palmer Apparatus for Determining Dust in Air

The Cost of Venereal Disease to Industry

The Mental Hygiene of Industrial Workers

Ambulance and First Aid

Mercurial Poisoning in the Manufacture of Clinical Thermometers

The Health of the School Teacher

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EFFICIENCY OF THE PALMER APPARATUS FOR DETERMINING DUST IN AIR*

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INTRODUCTION

IN connection with the improvement of conditions relating to the health of workers in the mining and metallurgical industries, the Bureau of Mines has co-operated with the U. S. Public Health Service in determining the amount of injurious dust suspended in the atmosphere. The three methods for dust determination most commonly used are: (a) washing out the dust from a measured flow of air with a water spray, as in the Palmer apparatus (1); (b) filtering out the dust from a measured flow of air with a water-soluble granular medium, as in the sugar tube method (2); (c) forcing a definite volume of air at high velocity through a small orifice against a coated glass plate to which the particles adhere so that they may be counted subsequently with the aid of a miscroscope. The Hill dust counter (3) and the Konimeter (4) depend on this principle. None of these methods is entirely satisfactory and all of them fail to include all the finer particles which are, when inhaled, the most injurious.

A critical study of the efficiency of these methods with respect to very fine particles seemed very important, especially as new means for making this study are now available in the methods developed for testing

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the effectiveness of gas masks and other protective devices against poisonous and irritating smokes. This paper gives the results of such a study of the Palmer apparatus and is the first of a series which will ultimately cover the various method for determining dust in air.

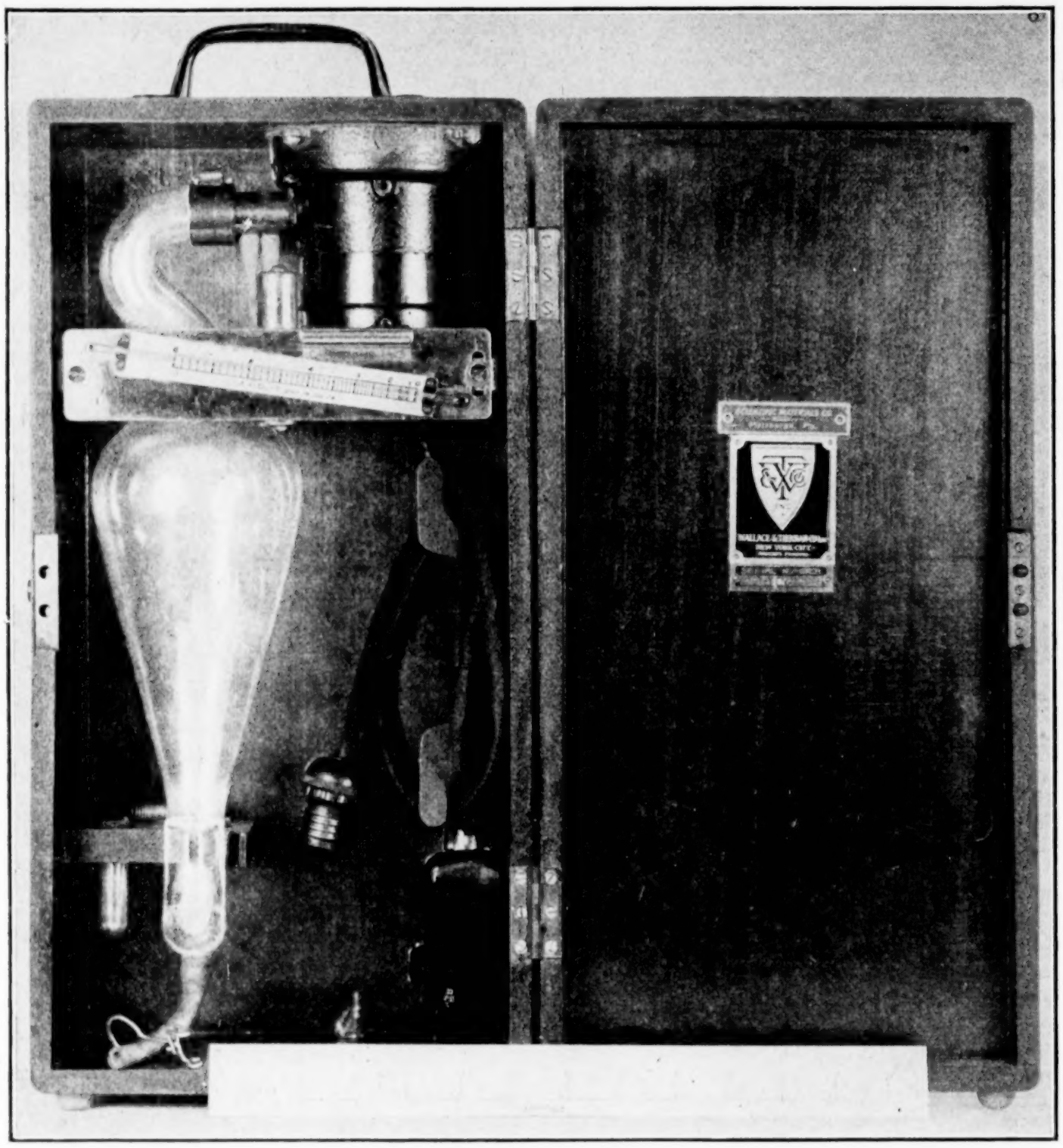

FIG. 1. — The Palmer dust sampler.

DESCRIPTION OF THE PALMER APPARATUS

Figure 1 shows the Palmer apparatus, which is completely built into a portable case. The washer consists of the large pear-shaped glass bulb with a U about one inch in diameter at the bottom. One side of the U is open to the air. Forty cubic centimeters of pure water are charged into it for a test; this amount causes the level in each arm of the U to rise one-quarter inch above the point of separation. Air is drawn through the water by means of a small blower, operated by a direct-connected motor using power from lighting circuits. The rate of flow of the air is measured by a pitot tube and an inclined gauge; the scale is graduated in cubic feet per minute, ranging up to 6. Rate of the flow is controlled by means of a sliding disk which closes the outlet from the blower.

To test the Palmer dust sampler, the pear-shaped glass bulb, which is the essen-

tial part, was removed from the case and connected into an apparatus for measuring its efficiency. Two methods of testing were employed. The first was based on optical comparison of the light (Tyndall effect) from suspended matter in the streams of incoming and outgoing air; tobacco smoke and air-suspended silica dust were used as testing mediums. The second method was based on weighing the matter, which passed the washer, by catching it in the small light tube of a laboratory Cottrell precipitator and determining its gain in weight.

The tests made in this manner showed that the Palmer apparatus removed not more than 13 per cent. of tobacco smoke from air, measured by the method based on light reflection. By the same method of measurement, silica dust, air floated and then filtered through cotton wool so that it was very finely divided, was removed to the extent of 30 per cent. when the suspension passed at the rate of 4 cubic feet per minute, and 20 per cent., at the rate of 3 cubic feet per minute. On a weight basis, as determined with the Cottrell precipitator, 45 per cent. of the silica dust was removed by the Palmer apparatus at flow of 4 cubic feet per minute. On a numerical basis the efficiency must be considerably lower than the 30 per cent. efficiency found by the optical tests.

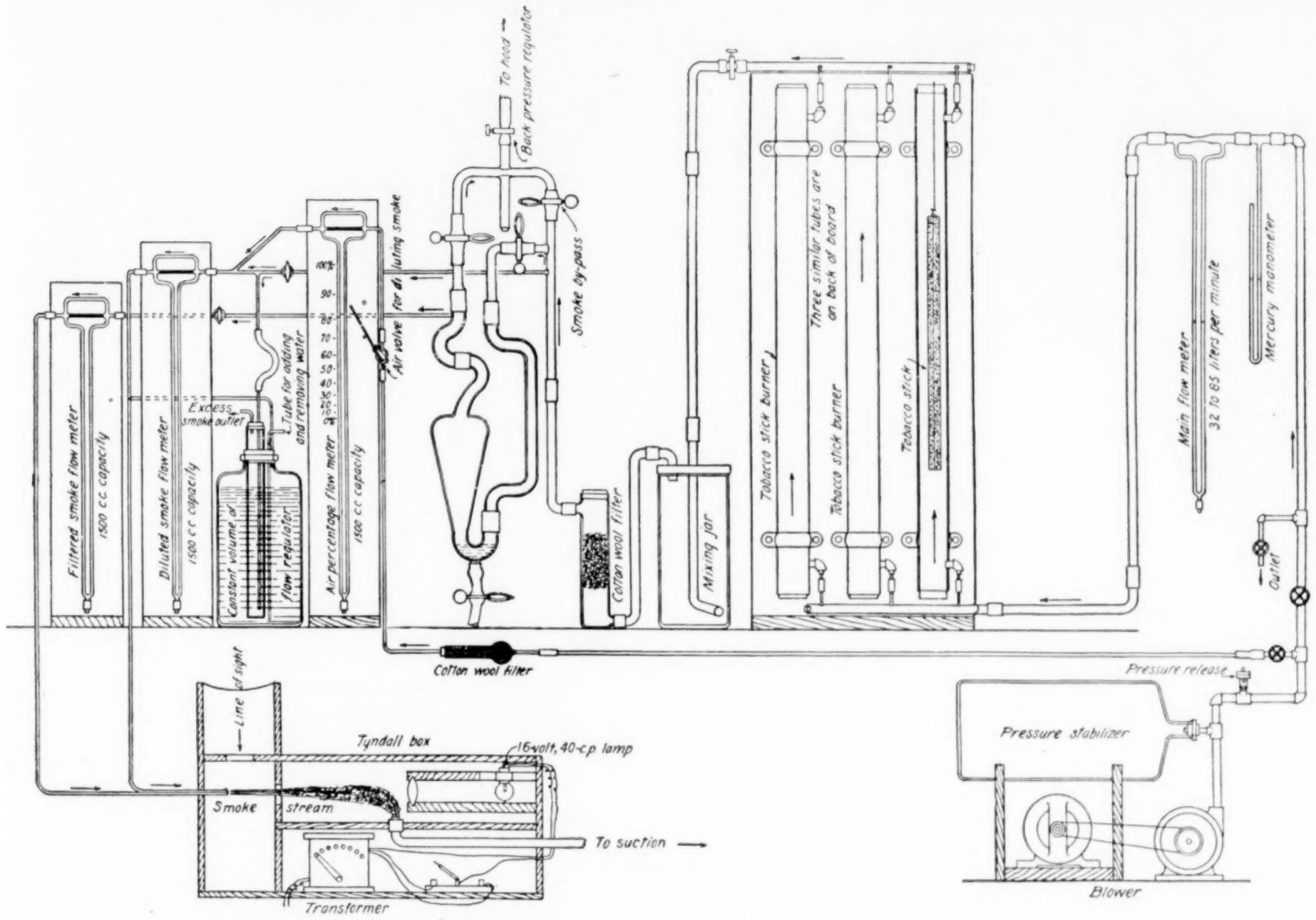

FIG. 2. — Apparatus for testing the washer against tobacco smoke, with optical measurements of washing efficiency.

TESTS WITH TOBACCO SMOKE

Description of the Apparatus for Optical Determinations of Efficiency

Figure 2 shows a diagram of the apparatus used for testing by the means of optical comparison, using tobacco smoke as the

testing medium. Wells and Gerke (5) showed that particles of tobacco smoke measured 0.273 microns on the average, with an average deviation of 1.8 per cent. The tobacco smoke used by Wells and Gerke (5) for these measurements was produced in the same way as the smoke used in the work described in this paper. Since tobacco smoke particles are of so small and uniform a size and have very little tendency to clog a filter, they make an excellent medium with which to test.

At the right of Figure 2 is a small motor-driven rotary blower which furnished air under pressure. The pressure was maintained at 100 mm. Hg by regulating a screw clamp on the outlet end of the apparatus. This pressure, which was sufficient to force air through the entire apparatus, against the resistance of the washer and other parts, was measured by a mercury manometer near the pump. After the manometer, in the direction of flow, is a flow meter which measured the rate of flow of the air. Regulation of the rate was obtained by means of the valves on the pipes near the pump. After leaving this flow meter, a portion of the air passed through the 2-inch iron pipes, arranged six in parallel, which constituted the tobacco burners.

The tobacco as used, had been molded into sticks by the following formula: Sun-dried tobacco leaf was ground and screened to the sizes needed. The sized material was mixed with potassium nitrate and rosin for binder, as well as smoke production, in these proportions:

Tobacco, 20–40 mesh	500 gm.
Tobacco, 40–60 mesh	300 gm.
Tobacco, 60–70 mesh	200 gm.
Rosin, through 100 mesh	475 gm.
Potassium nitrate through 60 mesh	100 gm.

This mixture was pressed into a sheet-iron mold of 1-inch-square cross section and 15 inches length, open on one side. The mold was lined with paper to prevent sticking. Candle wick was imbedded in the center of the tobacco stick to add strength. The mold and mixture were baked on a hot plate, under the cover of a half round of sheet iron, 3 inches in diameter. All four sides of the stick were baked in turn to a brown color, the mold being covered with a strip of sheet metal before inverting to bake the exposed side of the stick. Smoke from sticks prepared in this way showed no carbon and the ash was also free from carbon.

The air with smoke from the tobacco burners passed through a large jar where it was mixed with air which had been by-passed around the burning tobacco, and then through a small jar containing a wad of cotton wool for filtering out large particles. Then it passed through the pear-shaped washer of the Palmer apparatus. From the Palmer washer, the air, with included smoke, escaped into a hood. The tubes were also arranged so as to by-pass the smoke around the Palmer washer and to the hood directly, when desired.

The remaining apparatus was used for measuring the proportion of smoke which escaped the Palmer washer. On the outgoing side of the washer a small glass tube, connected to a stopcock and flow meter, allowed 1500 c.c. per minute of the filtered air and smoke to pass through a glass nozzle, one-eighth inch in diameter, into a light beam in a Tyndall box. Smoke from the incoming side of the washer was drawn through a similar small tube, stopcock and flow meter, and discharged through a glass nozzle in the Tyndall box, placed parallel to and one-quarter of an inch away from the other nozzle. The two systems for conducting the incoming and outgoing smoke to the Tyndall box were made identical in size and length of tubing, constrictions and bends, so as to have equal effects on deposition of smoke particles on the walls. In order to make a comparison of the den-

sity of the two smoke streams, the incoming, as regards the washer, was diluted with pure air from the pump. This air passed through a controlling stopcock, with long lever arm for fine adjustments, and a flow meter calibrated in percentages. It was then mixed with the incoming smoke before the smoke came to the 1500-c.c. flow meter. The latter flow meter was equipped with the device of Oberfell and Mase (6) which automatically maintained a constant flow of 1500 c.c. of gas. When no air was added 1500 c.c. of the undiluted smoke passed through the flow meter; when 1500 c.c. of air was admitted to the line, only air passed through the flow meter and the smoke passed out of the system and escaped into the room through the regulator. The smoke left the line from a point behind that at which the pure air entered so no admixture of smoke and air occurred before the excess smoke escaped. When any amount of the pure air less than 1500 c.c. was admitted, it passed through the flow meter, together with the amount of smoke required to make 1500 c.c., and the residual smoke automatically escaped. On the flow meter which measured the pure air, 1500 c.c. per minute indicated 100 per cent. Then if the washer was 50 per cent. efficient, or allowed half of the incoming smoke to pass through it, a mixture of half smoke and half, or 50 per cent., of pure air, was required in the Tyndall box to match the stream of smoke from the outgoing side of the washer. After matching the smoke streams by this arrangement, the percentage efficiencies of the washer were read directly from the water column of the percentage-calibrated flow meter.

The wooden Tyndall box was painted dead black inside. The beam of parallel light, opposite in direction to the streams of smoke, was provided by a lens and a 40-candle power, nitrogen-filled automobile lamp. Voltage was regulated by a small transformer using 110 volt power. Suction on the box removed excess smoke. The line of sight passed through a small opening in the box, which allowed observation of about 3 inches length of the smoke streams, just after they had passed from the nozzles.

Before measurements were made with the apparatus, it was tested blank; that is, with an unobstructed tube in the place of the washer. The smoke streams in the Tyndall box were required to match under this arrangement. In order to secure this result the apparatus required frequent cleaning.

TABLE 1.—RESULTS OF THE OPTICAL MEASUREMENTS OF EFFICIENCY OF THE PALMER DUST SAMPLER TESTED AGAINST TOBACCO SMOKE

Rate of flow of smoke, 4 cubic feet per minute; Water in Palmer bulb, 40 c.c.

	Order of Observation	Observations Perceptibly in Excess of True Efficiency	Observations Perceptibly Below True Efficiency	Remarks
Observations by No. 1, per cent.	1	13		Observations,
	2		0	even at 0 efficiency, were
	3	13		
	4		0	hardly perceptibly lower
	5	12		
	6		0	than the actual
Observations by No. 2, per cent.	7	12		
	8		0	
	9	10		
	10		0	
	11	18		
	12		0	
Aver. of excess fig.		13		

Procedure in Making Measurements

Experience has shown that a thin smoke serves better for making optical comparisons when efficiences are low — as in the case of the washer — so only one tobacco stick was burned at a time. When filtering efficiencies are high, denser smokes are better and six tobacco sticks may be burned

when measurements of very high efficiencies are to be made. The method assumes that the actual efficiency of the apparatus being tested is independent of the concentration of the smoke. Experience in both the Bureau of Mines and Chemical Warfare Service indicates this to be true.

The accuracy of determinations decreased with decrease in efficiency of the apparatus being tested. With efficiencies of 98 per cent. measurements could be checked to less than 1 per cent., but when efficiencies ranged at 25 per cent. or lower, errors of individual determinations might be 15 per cent. Because of the difficulty of accurate readings with low efficiencies, a number of observations were always made and, in general, this procedure was followed: First a reading was secured which was known to be greater than the actual efficiency by an amount just perceptible in the Tyndall stream; then a reading, lower in efficiency than the actual, was secured in the same way. A series of such alternate observations was usually made by each of two observers. The washer gave best results when air was passed through it at a rate of 4 cubic feet per minute, so this rate was used in the tests with tobacco smoke. At 5 cubic feet per minute some water was carried out of the tube mechanically, while at 3 cubic feet per minute there was less agitation of the water, less spray was produced in the tube and the washing effect was apparently poorer.

Results of the Tests

Table 1 gives the results of the tests. From these figures it is concluded that the Palmer dust sampler has an efficiency not greater than 13 per cent. in removing particles of tobacco smoke from air.

Tobacco smoke consists of liquid particles. Most dusts studied for hygienic purposes consist of solid particles. For these reasons the following tests were made with solid, silica dust.

Tests With Silica Dust

Description of Apparatus for Optical Determinations of Efficiency

In order to determine the efficiency of the Palmer dust sampler in removing solid suspensions from air, tests were made similar to those with the tobacco smoke but with air-floated silica dust as the test medium. The apparatus was the same as for tobacco smoke, except for the tobacco burner. The latter was replaced by an apparatus for creating a cloud or suspension of the dust in the air. The dust cloud pro-

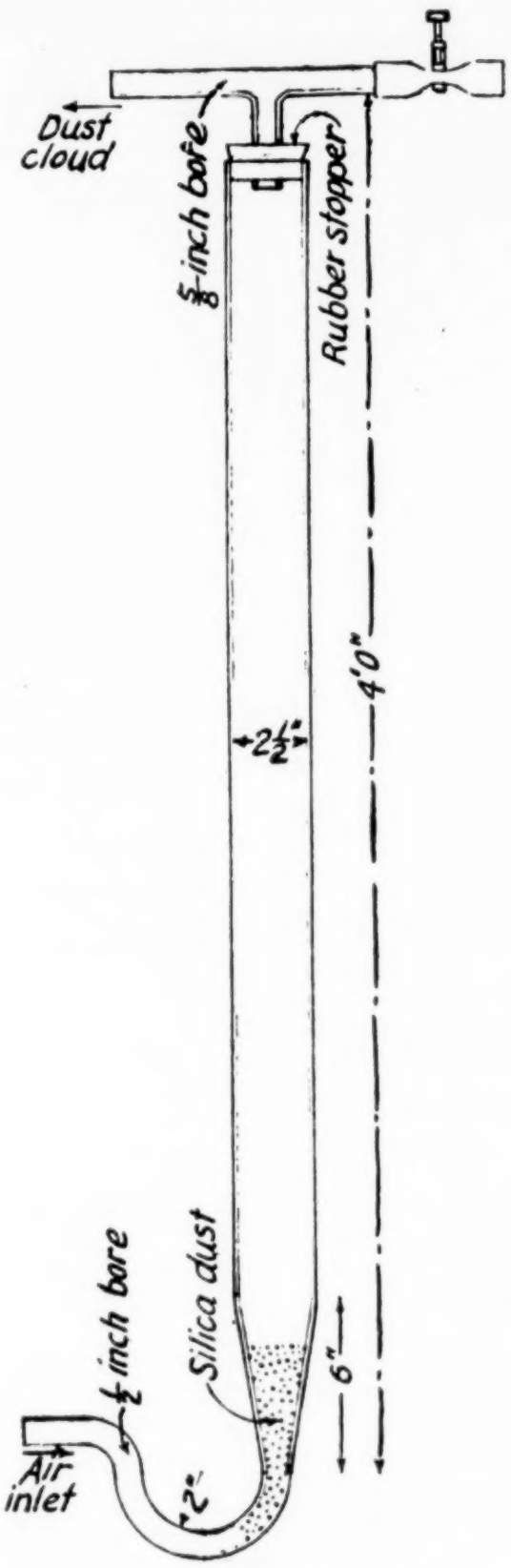

Fig. 3. — Apparatus for producing a suspension of silica dust in air.

ducer, shown in Figure 3, consisted of a wide glass tube, $2\frac{1}{2}$ inches in diameter, tapered at the bottom over a length of 6 inches, to $\frac{1}{2}$ inch diameter. The narrow tube was bent into a U to retain the dust.

TABLE 2. — RESULTS OF OPTICAL MEASUREMENTS OF EFFICIENCY OF THE PALMER DUST SAMPLER TESTED AGAINST SILICA DUST

Test number	1	2
Rate of flow of air — cu. ft.	4	3
Water in Palmer apparatus — c.c.	40	40
Readings of efficiency by No. 1, per cent.	44	39
	20	18
	46	30
	20	12
	45	40
	20	10
Maximum	46	40
Average	32	25
Minimum	20	10
Readings of efficiency by No. 2, per cent.	35	31
	23	10
	37	31
	14	5
	38	20
	18	0
Maximum	38	31
Average	28	16
Minimum	14	0
General average per cent.	30	20

At the top of the tube was a rubber stopper with one hole, through which passed a glass T. One arm of the T connected with the testing apparatus, the other was provided with a rubber tube and clamp, through which dust could be allowed to escape. About half a pound of silica dust was heated to 200 to 300° C. before being put into the tubes, and the air used was dried with calcium chloride. A small amount of moisture prevented formation of good suspensions.

The air carrying the silica dust was filtered through the wad of cotton wool before passing to the washer, so that only the smaller particles took part in the experiments.

With silica dust, precipitation occurred throughout the entire apparatus, gradually, but at a rate much more rapid than that of tobacco smoke. Cleaning was required more often and greater care was used to maintain Tyndall beams of equal intensities in frequent blank tests.

Results of the Optical Determinations

The results of the tests are given in Table 2. They show that the average efficiency of the washer for very finely divided silica dust in air, based on optical measurements is only about 30 per cent. This is at least two and one-half times the efficiency shown for tobacco smoke under the same conditions, which indicates a selective action upon particles of different kinds. Such differences in action may be due to differences in surface tensions resulting on contact of the different substances with water, differences in the electrical conditions of the particles, or differences in size of the particles. The latter seems most probable. Tobacco smoke particles are probably the smaller, and as will be shown later, smaller particles pass through the washer most readily.

At the rate of 3 cubic feet per minute the efficiency against silica dust dropped to only 20 per cent. Altogether, these figures show that the apparatus has an efficiency, under the conditions used, which is quite low.

Description of the Apparatus and Methods for Determining Efficiency by Electrical Precipitation

The optical method of testing gave efficiency measurements based on the combined surfaces — or, more exactly, the light reflected from the surfaces — of the particles leaving the dust sampler, as compared with the surfaces of the incoming particles. Dustiness is commonly reported

in terms of mass and numbers of particles, so the following experiments were designed to give information on a weight basis. Figure 4 shows the apparatus used. The precipitator was a duplicate of that used by Tolman, Ryerson, Brooks and Smyth (7). Current from the laboratory service line (110 volt, 60 cycle, single phase) was passed through a transformer of 500-watt capacity

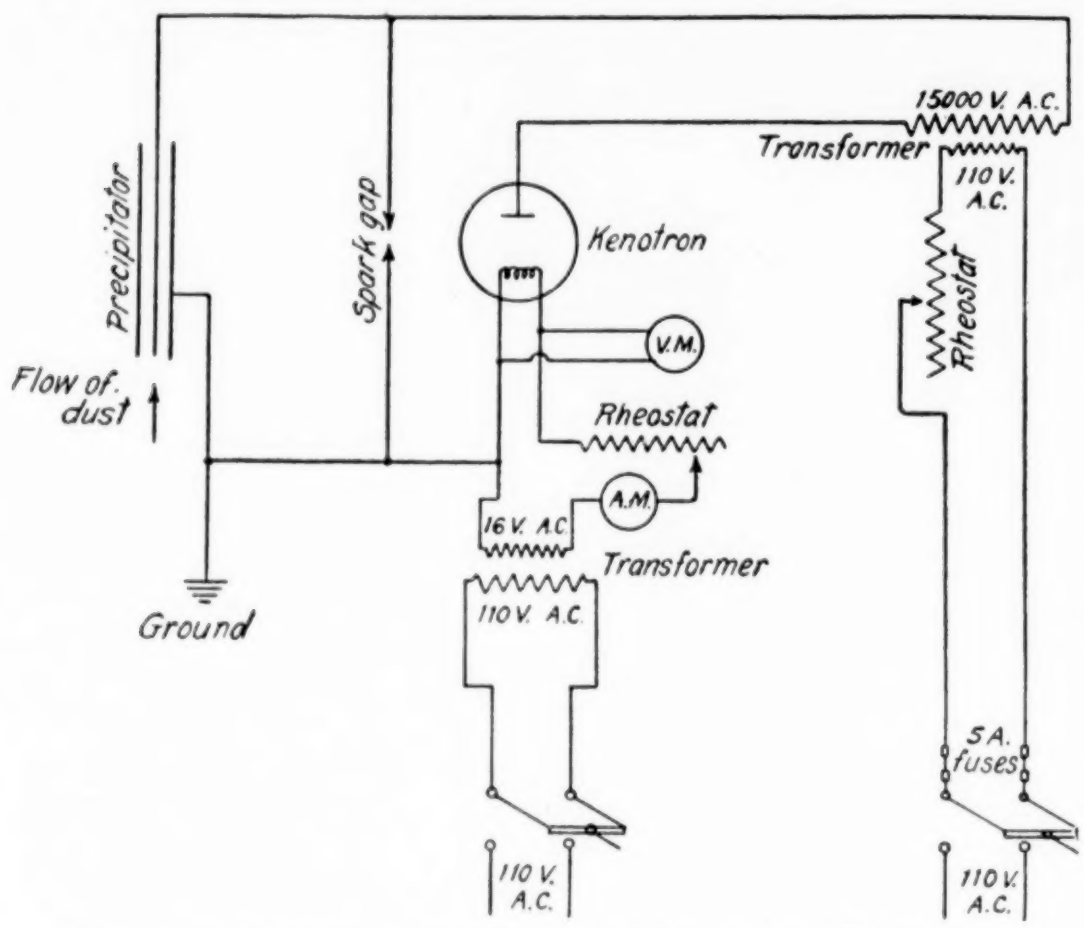

FIG. 4. — Diagram of apparatus used for testing efficiencies of the washer by means of a small Cottrell precipitator.

which stepped it up to a maximum of 15,000 volts. The actual voltage used, probably about 10,000, was controlled by means of a rheostat in the primary circuit. This high-tension current was rectified by a kenotron, which acted as a valve, thus delivering a half of the alternating cycle to the precipitator. The glower coil of the kenotron was heated by a separate transformer, which delivered current at 16 volts. A rheostat in series with the glower adjusted its temperature. The anode side of the high potential circuit was grounded. Voltage across the precipitator was adjusted by stepping up to the sparking point, then reducing slightly to a brush discharge.

The Cottrell precipitator, detailed in Figure 5, was too small to care for the whole of the 4 cubic feet of air per minute which passed through the Palmer tube, so only a portion of it, 32 liters or 1.13 cubic feet per minute, was used in the precipitator. Tests of this arrangement by means of the optical apparatus showed that silica dust was completely precipitated at the start, but as the anode became covered by the silica deposit an increasing amount of dust escaped. Optical measurement gave about 70 per cent. efficiency after one minute for the combined washer and electrical precipitator. The average efficiency of the two during the entire minute was thus about 85 per cent. While it is possible to obtain more complete precipitation with the Cottrell precipitator by reducing the rate of gas flow, other experimental errors are multiplied by the computations required. The arrangement described was therefore considered satisfactory for the purpose in view.

Aluminum foil tubes, which served as anodes of the precipitator, weighed about 0.5 gm. each. Before weighings the tubes were dried in an oven at 100°C. and cooled in a desiccator containing fused calcium chloride. Weighings were made on an assay balance, sensitive to 0.01 mg. Forty cubic centimeters of distilled water were used in the washer for each test. After the 4 cubic feet of air with suspended dust had been passed through the apparatus, the water with the dust caught was carefully rinsed into a beaker and then filtered through a 9-cm. analytical filter paper of close texture (C.S. and S., No. 589, blue ribbon), designed for retaining the finest precipitates. The silica particles were so fine, however, that the filtrate showed considerable turbidity which persisted even after passing through several separate papers or double

papers. Examination under the microscope by Dr. Reinhardt Thiessen of the Bureau of Mines, showed that most of the particles in the filtrate were of the order of 0.25 microns in diameter or smaller, and

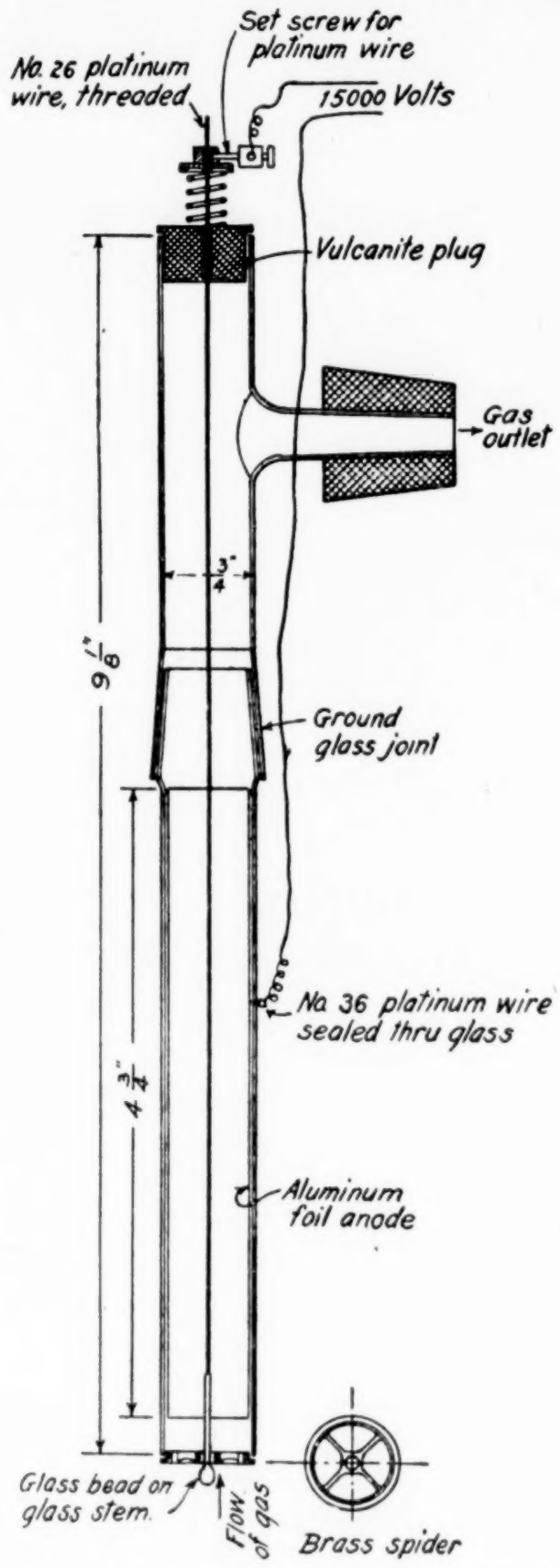

FIG. 5. — Details of the Cottrell precipitator tube.

the largest were 2 microns in diameter. To obtain an estimate of the weight of dust in the filtrate, turbidity standards in water were made with weighed quantities of the finest air-floated dust; the range covered 10 to 1000 mg. of dust per liter of water. Comparison of the filtrates and standards in similar containers and measurement of the volumes of filtrates gave means for calculating the weight of dust in the filtrates. The filter papers with the dust caught by them were ignited and the dust residue weighed. This weight added to that determined by turbidity gave the weight of dust caught by the washer. The sum of the weights of dust caught by the washer and Cottrell precipitator is actually somewhat low because even the two collectors had a combined efficiency less than 100 per cent. by optical determination. However, the result obtained gives a fairly close approximation.

TABLE 3. — RESULTS OF MEASUREMENTS OF EFFICIENCY OF THE PALMER DUST SAMPLER ON A WEIGHT BASIS, DETERMINED WITH SILICA DUST CLOUDS AND A COTTRELL PRECIPITATOR

Time of sampling, seconds	60	60	60
Data from Palmer washer:			
Water used, c.c.	40	40	40
Air passed, cu. ft.	4	4	4
Weight of dust recovered, mg.	35	32	22
Weight of dust in filtrate by turbidity, mg.	4	3	3
Total dust caught by Palmer tube, mg.	39	35	25
Data from Cottrell precipitator:			
Air passed, cu. ft.	1.13	1.13	1.13
Weight of dust caught, mg.	10.1	13.8	10.7
Final efficiency measured optically of the combined Palmer and Cottrell apparatus, per cent.	70	70	67
Total dust which passed through the Palmer tube, mg.	35.7	48.8	37.9
Total dust carried by the air sampled, mg.	74.7	83.8	62.9
Efficiency of Palmer dust sampler on a weight basis, per cent.	52	42	40

Results on a Weight Basis

Table 3 gives the results of the efficiency determinations on a weight basis. In the last column are the limiting maximum

efficiencies, 52, 42, and 40 per cent., found by three determinations. The average is 45. Actual efficiencies are believed to be not much less than the figures determined because the dust which escaped was probably so impalpably fine that its weight was of little consequence, although on the basis of surface or numbers the loss was probably large. The efficiency determined by weight averages 50 per cent. greater than that determined optically.

The results of the weight determinations show even a lesser efficiency than that found by Bill (8), who reports 63.0 per cent. efficiency on a weight basis for the Palmer dust sampler as compared with an electrical precipitator, as an average of 71 determinations made on different factory dusts. The efficiencies determined by Bill and the authors may be considered of the same order, and the differences are probably due to differences in the character and size of the particles handled.

Discussion of the Results

The optical methods of testing gave efficiencies based on the surfaces of the incoming and outgoing particles. Dustiness is commonly reported in terms of mass and numbers of particles, so it will be well to inquire into these relations as they concern the efficiencies determined by the two methods employed.

The aggregate surface of a given mass of silica particles, uniform in shape and composition, increases as the first power of the decrease in diameter of the particles. The numbers of particles in a given mass of dust, uniform in shape and composition, vary inversely as the third power of the diameter of the particles. Thus both surface and numbers of particles of a given aggregate mass increase with the fineness of division, but the number of particles increases at a rate very much greater than the surface.

On the basis of the above statements it may be that a small number of large dust particles has a greater mass but smaller surface than a large number of small particles. If the Palmer apparatus is more effective in removing large than small particles from the air, it is thus possible, with dust of mixed sizes, for it to show lower efficiencies optically than by weighing. Since the optical efficiencies were lower, it is concluded that the apparatus is more efficient for determining dust of larger sized particles.

Since the numbers of dust particles increase at a very much faster rate with fineness of division than the surface, and since lower optical efficiency was found, it is concluded that the efficiency of the washer on a numerical basis must be even lower than that determined optically.

Tobacco smoke, according to Wells and Gerke (5), consists of particles of quite uniform diameter, hence they may be taken as uniform in surface and weight. The efficiency of the washer — less than 13 per cent. — found by the optical method, is then a measure of the weight and number efficiency.

Summary and Conclusions

The efficiency of the Palmer dust sampler was determined by the use of tobacco smoke and of silica dust. Two methods of testing were used. The first determined efficiency on the basis of the surface of the particles entering the apparatus as compared with the surface leaving, by the use of the Tyndall effect. The second method, based on the weight of dust, used a small laboratory Cottrell precipitator in series with the Palmer washer. The tests showed:

1. That the Palmer dust sampler retained about 45 per cent. by weight of air-floated silica dust when air was passed through it at the rate of 4 cubic feet per minute.

2. The surface efficiency with silica dust, measured by the Tyndall effect, was 30 per

cent. when the air passed at a rate of 4 cubic feet per minute, and 20 per cent. at 3 cubic feet per minute; at 5 cubic feet per minute, water was carried mechanically from the washer.

3. The efficiency based on numbers of the silica dust particles is probably lower than the surface efficiency.

4. The Palmer apparatus was less than 13 per cent. efficient in retaining tobacco smoke, as measured by the Tyndall effect. Assuming tobacco smoke particles to be of uniform size, the optical efficiency of less than 13 per cent. should also apply to weight and number efficiency.

BIBLIOGRAPHY

1. Palmer, G. T.: A New Sampling Apparatus for the Determination of Aërial Dust. Am. Jour. Pub. Health, 1916, **6**, 54.
2. General Report of the Miners' Phthisis Prevention Committee, Union of South Africa, March 15, 1916, 199 pp.
   Final Report of the Miners' Phthisis Prevention Committee, Union of South Africa, January 10, 1919, 110 pp.
3. Hill, E. Vernon: Quantitative Determination of Air Dust. Heating and Ventilating Magazine, 1917, **14**, 23.
4. Final Report of the Miners' Phthisis Prevention Committee, Union of South Africa, January 10, 1919, 110 pp.
5. Wells, P. V., and Gerke, R. H.: An Oscillation Method for Measuring the Size of Ultramicroscopic Particles. Jour. Am. Chem. Soc., 1919, **41**, 312.
6. Oberfell, G. A., and Mase, R. P.: An Automatic Compensating Flow Meter. Jour. Ind. Eng. Chem., 1919, **11**, 294.
7. Tolman, R. C., Ryerson, L. H., Brooks, A. F., and Smyth, H. D.: An Electrical Precipitator for Analyzing Smokes. Jour. Am. Chem. Soc., 1919, **41**.
8. Bill, J. Penteado: The Electrical Method of Dust Collection as Applied to the Sanitary Analysis of Air. Jour. Ind. Hyg., 1919, **1**, 323.

THE COST OF VENEREAL DISEASE TO INDUSTRY*

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BUSINESS executives are ever on the alert to learn new methods for eliminating industrial wastage, from whatever cause it may result. They know that the strands of personal service strengthen the fabric of *efficiency*; hence their desire to secure better housing facilities for employees, their endorsement of "safety first" and public health movements, their co-operation in recreational efforts and their increasing interest in all activities covered by the general term, social hygiene. This attitude serves a threefold purpose. It conserves the health of the employee, promotes harmony between him and the employer, and increases the financial returns to both — the one through the medium of wages or profit sharing, the other by increased dividends. These reasons explain the rapidly increasing interest taken by industrial leaders in the national campaign for the control and prevention of the venereal diseases, syphilis and gonorrhea.

Industrial leadership is not the attribute of any particular city or state, but business executives, when it comes to a question of spending money, are almost unanimous in being "from Missouri." Their "show me" challenge was difficult to meet in former years, as venereal disease data presenting industrial wastage had not been compiled to any great extent. The records of the army since mobilization now remedy this defect to some extent, and give statistics on which fair estimates may be based. Practically all of the venereal infections in our national cantonments were contracted in civilian communities, more than two-thirds of them before the infected men were inducted into service. The draft army was composed of men taken directly from all strata of American life — the same men who make up a great percentage of the industrial army. The following facts and figures on the prevalence and seriousness of the venereal diseases in the army are, therefore, most pertinent to the question of the prevalence and seriousness of these same diseases in the industrial world.

Of the 967,486 men in the group known as the "second million," there were 54,843, or 5.6 per cent., infected with a venereal disease. The annual report of the Surgeon General of the Army for 1919, in comparing these figures with those for the first 500,000 and first million, says, "It is probable that the figures for the second million of 5.6 per cent. showed more clearly the correct percentage of the drafted men from civil life who were infected." During the year 1917, gonorrhea was the commonest cause of admission to sick report among soldiers in the United States and in 1918 was second only to influenza. In 1918 syphilis, gonorrhea and chancroid together were second only to influenza in number of admissions, exceeding by 87,871 admissions bronchitis, the next most frequent cause. Hence, it is evident that, with the exception of the unusual epidemic of influenza which prevailed in 1918, venereal infection was the greatest cause of disability in the army during the world war. The two years 1917 and 1918 witnessed the entrance of approximately 3,500,000 men into the army by induction or voluntary enlistment. In these two years the total time loss to the entire army from venereal disease was 4,825,661 days — 2,412,830 days per year. A low estimate of

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the number of men employed in the United States in manufacturing industries alone, today, places it at 10,000,000. Based on the above army figures the yearly time loss through venereal disease in this one group of industries is 6,893,800 days. As for the actual financial loss it cannot be approximated since this would necessitate figuring in the time lost through such complications as gonorrheal rheumatism and the various syphilitic conditions, decrease in working activity, and increased liability to accident.

These army statistics cannot be applied literally to industry, as treatment was obligatory in the service and men were withdrawn from the ranks for longer periods than they would be absent from business. The figures indicate, however, a fair estimate of time necessary for thorough treatment. Then, too, it must be understood that while a worker would not always be actually out of employment ten days, as in the army, he would nevertheless be ailing and non-effective in his work to a far greater extent than the army's ten-day average represents. The necessity for frequent micturition, the inability to keep mind and body "on the job," the constant tendency to "ease up" — these, together with the actual time taken off for treatment and that spent in bed, either at home or in a hospital, are elements to be taken into account. It would, consequently, be fair to consider these factors in estimating the loss of time. It is not possible to compute with accuracy the extra compensation paid to employees by insurance carriers for the delayed recoveries from accidents where syphilis and gonorrhea are contributing agents, but this too is an important factor to consider.

The plant surgeon of a large steel company relates the following instances:

Case 1. — A heavy man turned his ankle in making a misstep. After being sent to the hospital an X-ray was taken. It was negative and the injury was diagnosed as a sprained ankle. Ordinary time for recovery would have been four to six weeks but, owing to latent syphilis, this man was compensated for seven months before he was able to return to work. The slight injury stirred up this syphilis and the resulting complication increased the expense to the insurance carrier from $72.15 (which would have been the compensation had the disability lasted the ordinary period of six weeks) to $336.

Case 2. — An employee in the course of his work sustained a fracture of the lower third of the femur (thigh bone). In April, 1918, one year had elapsed since the accident, but the fracture had not united and the man was still on crutches. The insurance carrier had paid one year's compensation besides the first two weeks' medical service. Figured at the lowest rate this would have amounted to $260, plus a two weeks' hospital bill. If the company had been able to stop payments then, it would have done its full duty as, in one year, a fractured femur should be united and the patient back at work. As in Case 1, syphilitic complications were responsible for the delay, but in Case 2, "The chances are very much against his *ever* recovering sufficiently to work," hence the insurance company must continue paying his compensation.

To combat this venereal disease menace, hundreds of the nation's greatest business organizations have joined in the industrial campaign now being carried on under the leadership of the United States Public Health Service, the U. S. Interdepartmental Social Hygiene Board, state boards of health, and the American Social Hygiene Association.* These public organizations are co-operating in the establishment of clinics and in the dissemination of rational health education, while the American Social Hygiene Association, as a civilian agency, is giving the program its full support, its endeavors being directed more particularly along the educational line.

* The Division of Venereal Diseases, United States Public Health Service, 228 First Street, N. W., Washington, D. C., will furnish you with full and complete information on clinics and will co-operate in their establishment.

The American Social Hygiene Association, 105 West 40th Street, New York City, working with them, will provide at cost forceful, up-to-date educational material — material which has already been used to great advantage in hundreds of the nation's greatest industries, such as the Phelps Dodge Corporation, the Hercules Powder Co., the DuPont de Nemours Co., Kelly-Springfield Tire Co., Emergency Fleet Corporation, Westinghouse Electric Co., etc.

The first question asked by an executive is, "How best can industry co-operate in the campaign?" An authority on industrial hygiene answers this as follows:

> First, by seeing that the community has treatment facilities in the form of a venereal disease clinic as part of (1) a general dispensary connected with a hospital, (2) a health center doing treatment work, or (3) an isolated clinic under official (health department) auspices.
>
> Second, by doing educational work within the plant. In this connection one plant doctor claims that far better results can be secured by subsidizing local public clinics for treatment purposes than by spending the same amount for a plant venereal disease clinic; then placarding the plant extensively and distributing educational material to the employees.
>
> Third, by providing better environmental conditions and more wholesome recreational facilities.

The foundation of the whole campaign is the public health equipment of the community. It is essential that this be in condition to function, for education and recreation cannot do a complete job without it. In fact some educational campaigns have failed because local clinics, when confronted with a large number of new cases, have curled up and died.

A second question usually asked by the executive is, "Will the clinic be extensively patronized?" Health officials answer this in the affirmative on the following grounds: Oftentimes the men have been cheated by quacks: others have gone to ethical doctors who have proved incompetent in the diagnosis and treatment of venereal cases. Many, to their sorrow, have experimented with "3-day" gonorrhea cures and other over-the-counter nostrums. When they learn, therefore, that their own plant is cooperating in a great national campaign to provide adequate medical facilities under skilled supervision, they are quick to take advantage of these facilities. Any idea that the owners or executives have ulterior motives in aiding this movement has been thoroughly removed by the knowledge that the government has asked their aid and that the American plan for controlling and preventing venereal diseases has been endorsed by the American Federation of Labor. Under no circumstances, however, should the clinics be designated as venereal disease clinics, since the natural effect of such designation is bad. Venereal cases should be so handled that no greater publicity is given them than is accorded any other ailment.

A few actual examples of work already accomplished will emphasize the need for and value of these measures. A northern New York firm having 3,000 male employees followed the government's suggestions and adopted educational and clinical measures. Thirty cases applied for treatment within the first few weeks. One man had spent $800 for quack treatment, which, as is usually the case, had failed to provide the promised cure. By placing the case in the hands of a competent doctor and expending $50, the company brought about his cure.

An influential manufacturing concern in West Virginia followed the advice of a health expert and aided in installing a clinic for the free treatment of venereal disease at a cost of between $5000 and $6000 for the first year. The plant had a payroll during this period of $125,000. The president of the firm has informed the United States Public Health Service that as a result of the clinic treatment, labor efficiency was improved $33\frac{1}{3}$ per cent., which gave him a return of $40,000 from the investment.

A corporation, among its other activities, built a city in a wilderness for the housing of thousands of men and women employees. When efficiency dropped below expectations the officials sent experts to conduct a survey and find the cause. This investigation showed:

1. That one employee in every ten had a venereal disease.

2. That 68 per cent. of non-effectives were on the non-effective list because of venereal disease.

3. That every person who had a venereal disease lost three times as many hours from work as the person not affected.

4. That it cost every person so afflicted $75 per year for treatment; a total of $50,000 for treatment, with a loss of time greatly exceeding this amount.

This survey convinced the officials that it would repay them to take steps for remedying the situation and they asked the United States Public Health Service for help. An immediate response was forthcoming and co-operation given toward the establishment of clinics where the employees could be treated. In a comparatively short time the cost of operating the clinics was entirely offset by increased production.

It is not an uncommon thing nowadays for groups of industries to combine in making an adequate appropriation for the local health department to work with. They are realizing that disease cannot be controlled from within the plant but that certain helpful measures *can* be carried on therein. These general truths apply specifically to the fight against syphilis and gonorrhea, a public health campaign presenting the opportunity for a combination of true altruism and good business judgment.

Summary

1. Army statistics, being fair and comprehensive, form reliable grounds on which to base estimates of loss to industry through the venereal diseases.

2. A conservative estimate of the number of cases in the 3,500,000 men, drafted and enlisted, who were in the army during 1917 and 1918, shows 5.6 per cent. infected with a venereal disease. Excepting the unusual incidence of influenza, the venereal diseases accounted for more men on sick report than any other disease.

3. It is impossible to estimate with accuracy the loss due to such causes as rheumatic and other venereal disease complications, frequent micturition, decreased efficiency, increased compensation payments necessitated through slow healing of wounds, etc.

4. Industrial aid in controlling venereal diseases can be made most effective through financial and moral assistance to local public treatment facilities rather than through plant clinics. Much may be accomplished within the plant, however, through placarding and the distribution of educational material.

5. Several demonstrations have proved that a reasonable appropriation for fighting these diseases will more than pay for itself in increased efficiency and lessened labor turnover.

THE MENTAL HYGIENE OF INDUSTRIAL WORKERS*

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THIS important topic involves such a broad scope that it is impossible to give more than scant consideration to it in an article of this length, and only a general concept of the mental hygiene of the industrial worker is reviewed.

The social and economic customs of our present standards of so-called civilization making it necessary for the average individual to toil for his existence at an early period in life, it becomes at once apparent that a slight understanding of man's attitude towards compulsory labor is of value in tracing his mental reactions to various kinds and grades of labor. The primary and paramount object of the average industrial worker is to get as much remuneration for his services as is possible; and that of the average employer is to get as much service as possible for the remuneration he gives. These are the two opposite extreme mental aims of employee and employer — notwithstanding all statements to the contrary — and it is this mental attitude which causes the existing wide gap between capital and labor. From the very commencement of his industrial life the future worker has instilled into him these fundamental relationships between himself and his employer. Parents seek to place their children at work which brings the largest financial rewards in the shortest possible time. The average future industrial worker is initiated into industry not with a mental concept of endeavoring to determine how much good he can do to the advancement of mankind, but how much money he can get for what he does. Under these conditions it is easily understandable that the mental hygiene of the industrial worker is of the utmost importance to the worker himself, to his employer, and to society in general. At the present, the mental hygiene of many industrial workers, especially of so-called organized labor, is in a distinctly unhealthy state. Unfortunately industry is as much to blame for this condition as is labor. Employers who pay no attention to the mental hygiene of their workers will eventually pay the price for their negligence. Industrial mass-mind not kept clean, busy, and amused will soon decay, and as the result of this decay discontent, strikes, and riots are bred. Few large industrial plants which have provided active welfare movements based upon a careful study of the psychology of employees have had to confront serious labor difficulties in the present acknowledged industrial turmoil.

Industrial workers absolutely require rest, recreation and mental tranquility for that stable mental equilibrium which brings forth their greatest powers of productivity and keeps them satisfied workers. The nature of the various kinds of industrial labor is almost as varied as are the industries themselves, but practically all work may be grouped into four chief categories; namely, skilled and unskilled, monotonous and diversified. All work carries with it mental and physical reactions, and it is the nature of these reactions which make work a pleasure or a burden. Let us therefore briefly note the psychic effect upon the worker of various kinds of labor. By psychic effect I mean the reaction of the emotions, moods, and other mental processes to labor; I do not mean the reactions

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produced upon mental processes by a physically overworked body which may, for our purposes, be considered abnormal.

As a rule, skilled work carries with it a certain degree of mental satisfaction which to a large extent overcomes any disagreeableness associated with its performance. An engraver may have a most nerve-racking time in cutting a difficult scroll upon a hard piece of metal, but when the task is completed he is possessed of the mental satisfaction of seeing a difficult job well done, and is also in possession of a conscious or unconscious sense of mental exhilaration which greatly relieves the after-effects of the nervous tension under which he may have been laboring for days previously. An automobile mechanic may spend hours of time in vainly endeavoring to start a balky engine, but when he has accomplished his task his mental tension is greatly relieved and the unpleasant effects which usually follow such tension are thereby greatly diminished. Mental exhilaration is an accompaniment in various degrees and forms of most skilled constructive labor. There are other forms of skilled labor, however, such as bookkeeping, accounting, etc., where the result of mental tension is only rewarded by a sense of relief that the task is done; there is not that sense of satisfaction accompanying many kinds of clerical work which comes from the ability to look upon a finished piece of work, the construction of which may be seen by others as well as by the worker himself. In other words, work which shows no material results visible to everybody is not apt to carry with it the mental satisfaction accompanying visible construction.

Much of the unskilled labor of our industries, on the other hand, is monotonous, uninteresting and fatigue-producing. Such work carries with it little or no mental satisfaction and consequently may, and often does, carry the worker into one or two channels of mental inertia. The worker, finding no mental stimulus in his work, very often becomes a mere automaton; his mind wanders from topic to topic, and, if employed at mechanical labor, he easily becomes the victim of industrial injury due to inattention. Day dreamers are made of thousands of industrial workers through lack of mental stimulation during working hours. Many of these workers get duller and duller as the time goes on so that to a certain degree they become near-morons according to mental classification. Mental monotony to the extent of allowing habits of introspection to form is one of the greatest banes to industrial workers, and should be made the subject of special study with a view to diminishing its frequency. Table 1, taken from an interview of thirty-one workers between the ages of 16 and 51, consists of replies to the simple question of "What are you thinking about at the

TABLE 1. — REPLIES TO QUERY, "WELL, WHAT ARE YOU THINKING ABOUT?"

Sex	Reply
Male	Phonograph records out for March
Female	Pain in her tooth
Female	How many covers she had made
Female	Thinking about sick child at home
Male	What work he will be put on after this job is done
Female	Whether or not she would go out to-night
Female	Thinking about forgotten door key
Female	That she had not received a cut for a long time
Female	Whether or not I would speak to her about not wearing a cap
Male	Says he is thinking about nothing in particular
Male	Thinking about forthcoming prize-fight
Female	Thinking about a dance she is going to to-night
Female	Thinking about pain in her foot
Female	About some work she spoiled and for which she was reprimanded
Female	About going somewhere to-night
Female	About getting a new suit
Female	About some altercation she had with a co-worker
Female	The slowness of her partner at work
Male	What time of the day it is
Female	How she is going to get home without rubbers
Female	Of the whereabouts of a friend
Male	About getting a haircut before going home
Female	About how painful a cut is which she received
Female	Whether it will clear up or continue to rain

moment ?" The workers interviewed were all sufficiently acquainted with the interviewer so that the question caused no surprise or other serious mental reaction. In fact the query was made at a time when the workers were in their most familiar surroundings — namely, at their work — and the question was put in a casual manner only to those who had become familiar with the questioner through previous relationship as physician and patient. While it is true that simple replies to a simple intimate personal question may not represent the actual thoughts in these workers' minds at the time, nevertheless I believe that the majority of replies were made in good faith — an opinion based upon the truth of other statements by these same workers in past dealings with them.

Undoubtedly some of the thoughts expressed were aroused by the associations which some of these workers had with me as the result of slight injuries, while others may have been brought about by similar thought associations. Out of all the replies, it would seem that only three related directly to the work which was being done. Only one person stated that he was thinking about nothing in particular, which of course, strictly speaking could not have been true. The chances are that he did not care to state what he was thinking about. Most of the replies indicate clearly enough that the minds of these workers were upon almost anything but their work, and when consideration is taken of the fact that the great majority of the workers were operating dangerous machines at the time, it becomes evident what a source of danger mind-wandering really is. To illustrate how far some industrial concerns have gone in attempting to break the monotony of certain work and in trying to keep the employees' minds centered in the activities of the factory surroundings, one shoe factory has had a victrola mounted upon wheels, and this is carted from department to department playing popular music to break the monotony of the work.

Industrial workers, whether skilled or unskilled, all require three cardinal processes to rejuvenate their sapped vitalities from day to day. These are: physical exercise, which brings into play those muscles not used during the daily work, mental recreation, and a good night's sleep. Upon the varied application of these cardinal points rests the secret of industrial efficiency and contentment. First, let us consider physical exercise. The average industrial worker will probably try to make you believe that he gets all the exercise he requires out of his work. This is, as a rule, not the case. Most active exercise in connection with industrial pursuits calls into play only certain muscles, to the neglect of others, thereby creating an unevenly developed musculature. We cannot have a healthy mind without a healthy body, and it is, therefore, of importance that thephysical well-being of the industrial worker be kept as nearly perfect as possible if we would have him enjoy a good state of mental hygiene. The kind of physical exercise in which the industrial worker should indulge depends entirely upon the nature of his work. While almost any form of exercise is good, out-door exercises are best. Group exercises are better than those practiced in private. Games, calisthenics, etc., in which large numbers may participate, carry with them a certain degree of mental stimulation in addition to the pure physical exercise which is of especial value to the industrial worker. Unfortunately, however, the predominating exercises stimulated in many industrial plants are base-ball, foot-ball, and other team contests where the minority get the benefit of the exercise while the great majority do the looking on. Sports where large numbers may participate should be popularized to a much greater extent for the benefit of industrial workers.

Exercise, like all other good things, may be overdone. The industrial physician is very often consulted for the relief of the effects of a holiday of such strenuous exercise that the worker becomes less efficient in the performance of his duties until the soreness is relieved. The ideal manner in which to control exercises for industrial workers is by having them under the direct supervision of a physical director employed for the purpose. If more reliable statistics were available, there is little doubt but that most industrial concerns having well-organized systems of providing systematic exercise for their employees would show a decrease in time lost from illness as compared with less progressive plants. In attempting to obtain actual figures to prove this contention, considerable difficulty was encountered. In the first place, many employers who have gone to the expense of employing physicians or nurses have no knowledge of the time lost through illness in their plants. Then again others were encountered who did keep a record of time lost from this cause but who had no means of providing systematic exercise for their employees. After considerable difficulty Table 2 was compiled, and, taking into consideration the present dearth of records of sickness-loss in most industries, there is every reason to believe that it is as correct as any figures compiled from mixed sources.

TABLE 2. — EFFECT OF EXERCISE ON TIME LOST FROM ILLNESS

Industry	Per Cent. of Employees Ill All of the Time	Per Cent. of Employees Indulging in Systematic Exercise	Per Cent. Ill All of the Time Among those Exercising Regularly
Paper goods	4.76	6.5	3.83
Machine parts	6.43	42.0	4.09
Textiles	7.79	14.0	4.41
Shoe industry	4.93	7.0	4.33
Food products	3.8	72.0	2.64
Life insurance office workers — physical examination required	3.21	84.0	2.14
Five gymnasium classes, comprising three for males and two for females ..	Annual percentage of illness in those who study (Male) ..... 1.73 Annual percentage of illness in those who study (Female) ..... 2.04 Annual percentage of illness in those who work (Male) ..... 1.83 Annual percentage of illness in those who work (Female) 2.17		

The first thing of importance which strikes one as a result of a study of this table is the high percentage of illness among these workers in general. It is conceded, I believe, from exhaustive statistics compiled that only between 2 and 3 per cent. of the American population have been found to be ill all of the time. The higher percentages in this table are probably due to the comparatively small number upon which these figures are based, or due to the time at which these figures were obtained. Roughly speaking, the industries included in this table employ altogether about 16,400 workers, the largest single plant being in the textile line, and the smallest in the insurance business. The table was computed from figures submitted during the first three months of the year when illness is apt to be more frequent than at other times, and since two of these six industries submitted figures based upon the percentage of illness at the time of query instead of on the annual loss from this cause the chances are that these figures would average a little lower for the year round. Out of 16,400 workers — of whom about 37 per cent. take systematic exercise — the difference in percentage of constant absence from illness among those who systematically exercise and among those who do not is 1.611 per cent. In other words, out of about 6100 industrial workers who exercise regularly, there are about ninety-seven less on the constant sick list than among those who do not exercise systematically. These figures roughly demonstrate the value of regular exercise for industrial

workers, and if more extensive and accurate figures were available there is little doubt but that far greater benefits would be shown. The list of pupils of gymnastic schools and organizations has been appended to the table for the purpose of making a comparison of the effect upon health of exercise taken under expert supervision and that taken without expert guidance. The ages of those attending gymnasium classes average very closely to those of the industrial workers taking exercise without expert guidance, so that it can hardly be said that the low rate of illness among members of gymnasium classes is due to their being younger. The very low illness rate among members of gymnasium classes, even among those who must do their exercising after a hard day's work, should be of sufficient interest to warrant further investigation from every employer of labor who has efficiency and production at heart.

Next to the physical well-being of the industrial worker, there is nothing more important than his mental contentment. All work and no play is not conducive to the best interests of the worker. Exactly what is required for the contentment of the worker is an individual problem, but all industrial workers require recreation. In guiding as much as possible the recreational activities of his workers, the employer goes a long way towards creating contented workers. Workers will, to be sure, seek and find recreation of their own accord, but like physical exercise, their recreation is often apt to be misdirected from the point of view of their own best welfare. Then again, what is recreation to one may seem drudgery to another. The industrial worker who does hard physical labor all day seeks a far different form of recreation than the man who toils mostly with his brain. While individual tastes undoubtedly play an important rôle in recreational activities, and even though recreation is a voluntary act, this by no means precludes its being wisely directed. Employers in many large industrial plants located in suitable communities have completely altered the recreational habits of their employees through patience and well-directed welfare movements. For instance, the dance hall, which forms the chief recreation of thousands of young industrial workers, may be transformed from a cheap ill-conducted place where both the physical and moral health of the workers is impaired into a place of wholesome recreation, devoid of all ill after-effects. Organizations employing much skilled labor, whose advancement depends upon educational preparation, have found it profitable to themselves and to their workers to conduct semi-social gatherings after working hours in which both recreation and education play a part.

The entire range of the mental hygiene of the industrial worker revolves about a psychological axis as its center. The worker who spends eight or more hours a day at industrial work requires a daily change of thought, change of scene and change of routine in order to keep his mind from entering upon a path of dissatisfaction. Habits of introspection, while valuable enough for scientific purposes, are as bad for industrial workers to indulge in as they are for hypochondriacs. This being a materialistic rather than an idealistic world in which to live, it is but natural that the industrial worker should most easily follow lines of thought leading him into an attitude of self-pity and dissatisfaction with his lot. These lines of mental activity when indulged in by mass-mind lead toward the road of industrial unrest. The mind of the worker should be kept clean at all times, and this ideal can only be approximated if the mind is kept active along proper channels. Just because a worker may have been engaged in hard mental labor all day long is no reason why

his mental activities should absolutely cease after working hours. Every bodily function is normally rhythmic and there is reason to believe that psychologic functions should also be carried on in a rhythmic manner. In exercising the mind, as in exercising the body, after working hours those parts should be brought into activity which have been inactive during working hours. The industrial worker, as well as any other worker, uses his brain constantly. His train of thought is apt to be far away from his work, as is shown in the list of answers to our query as to what was being thought of at the moment. His thoughts may not be profitable to his employer, but his mind is working in a sort of day-dreaming fashion just the same. To keep the worker's mind equally or more active during working hours along constructive lines of thought should be the aim of every employer, and if successfully carried out will result in a better balanced mentality, beneficial both to the employee and to his employer.

One of the most commonly used methods of attempting to create contentment in industrial employees is to hire them with either a promise of, or allusion to, opportunity for advancement. This method, there is some reason to believe, is being used too often in an insincere manner. To give an employee the impression that advancement awaits him, when in fact there is no such bright opportunity in sight, is only fooling him for a certain length of time; such a method reacts as a breeder of discontent and becomes a cause of increased labor turnover. It would seem far better to keep the mental expectations of an employee up by letting him have a taste of something better which may be in store for him when the opportunity arrives. There are but few lines of work where it would be impossible to teach a worker the duties of the man superior to him; such a procedure encourages the employee greatly to look forward to something better, it actually prepares him to fill the position of his superior, and in case of emergency gives the employer the benefit of continuing uninterrupted activity by having two men trained for one job. In dealing with the mentality of industrial workers, as in many other things, deeds make a far deeper impression than do mere words.

Next in importance to a physically healthy body and mental contentment for the industrial worker is a good night's sleep. The human economy absolutely requires a fair amount of sleep for its repair and restoration from day to day. While there is undoubtedly a great variation in individual requirements as to the amount of sleep necessary to bring about rejuvenation of vitality expended during waking hours, it is, nevertheless, a fact that probably most workers under the age of 30 get too little refreshing sleep on six nights of the week. This state of affairs is due partially to our social system of recreation, and partly due to economic and racial conditions. Nowadays many of our young industrial workers do not get sufficient sleep because of late dances, theatre parties, midnight suppers, and the like. This is by no means theory, but fact which may be easily proven by frequenting the amusement places patronized between the hours of 10 and 12 by our young industrial workers. It very often happens that when these workers do get to bed they sleep amid unhygienic surroundings, and the wonder is that they stand up as well as they do.

While unhygienic personal habits are partly due to economic conditions, racial peculiarities also play an important part. Many industrial workers whose incomes far exceed those delegated to inspect their living conditions, live amid unhygienic surroundings. With the present inflated wage scales it is not uncommon to find a professionally trained person whose duty

it is to investigate the conditions of tenements — a person whose income is considerably smaller than those of the workers inhabiting the tenements. Yet, notwithstanding this fact, the investigator would not think of living under the conditions he sees in his daily work, and this despite his smaller income. Unhygienic living conditions, which undermine both the physical and mental health of the workers, are very apt to be due to lack of education or to lax public health supervision rather than to economic conditions. A worker appearing in the morning after a night of insufficient or restless sleep is apt to be irritable in mind and slow in movement. He will almost certainly be less productive and is peculiarly susceptible to industrial injury. A good night's sleep is just as essential to the worker as a good meal, and it behooves industry to aid him in every way possible in obtaining it.

The various methods by which employers may prevent their workers from getting into ruts of mental decay can hardly be put down in the form of set rules or directions. Each employer in each industry will meet problems peculiar to his own plant and to his own employees. That the mental hygiene of industrial workers ought to receive more attention than it does at present is conceded by many, but how to keep the psychologic state of industrial mass-mind in good form for efficiency and contentment are as yet unsolved problems. A beginning along these lines has been made, and it is earnestly hoped that as time goes on more attention to the mental hygiene of industrial workers may be paid by the industries. The reward therefor will be diminished labor turnover, less industrial unrest and increased production, to the great benefit of the industrial worker himself and of society in general.

AMBULANCE AND FIRST AID*

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His Majesty's Medical Inspector of Factories

PERHAPS nowhere is the old adage regarding the happening of accidents better exemplified than in factories. Where the human element is a contributory cause, accidents will happen at one time or another in spite of all precautions. The Welfare Orders dealing with ambulance arrangements and first aid issued by the Home Office under Section 7 (2) of the Police Factories, etc. (Miscellaneous Provisions) Act, 1916, are issued to reduce the consequences of accidents. The two fundamental principles of these orders are first to treat all wounds, however trivial, so that the workman may quickly return to his work in comfort and safety, and secondly to prevent, as far as possible, serious accidents from becoming more severe.

Records of accidents over many years have shown that it is not always the severe accident that in the end proves the most serious; loss of a limb or even of life has followed apparently minor injuries, so trivial in fact as to encourage neglect when first received. By neglecting wounds such as these and continuing at work the worker runs the risk of blood poisoning. The main objects aimed at in the orders are, that the treatment shall be immediate, simple of application, and that the dressing applied shall reduce as far as possible all risk of infecting the wound. Great importance is attached to immediate treatment; the longer a wound, even a very small one, remains untreated, the greater is the possibility of infection. Simplicity enables a large number of persons to be instructed easily in the method and use of a first aid dressing, while a sterilised dressing, which can be applied without that part which is to cover the wound being handled, reduces the possibility of infecting the wound to a minimum. A reduction of approximately 50 per cent. in the number of septic cases has been reported in one factory after the introduction of the first aid boxes.

These are the principles which underlie the first aid orders and apply in particular to the first aid boxes equipped with sterilised dressings, which have to be placed in the works themselves and in positions within easy reach of all the persons employed. The dressings, in addition to being packed so that they remain sterile, should also be of such a character as to be suitable for the injury for which they are intended to be used. The orders require a certain number of dressings for the finger, hand or foot, and large dressings for other parts of the body. Since the issuing of the orders many first aid boxes have been seen in the factories visited which, although they fully comply with the letter of the requirements, fail to provide the most suitable or convenient dressing. This defect has been observed especially in the case of the small dressings for the finger which, generally speaking, have been too bulky and put up in such a way as to make their successful application difficult. In August, 1917, a conference was held with the principal manufacturers of surgical dressings at which the nature and quality of sterilised dressings was fully considered. A further conference was held in June, 1918, at which the question of standardization was discussed. Experience will necessarily suggest modification and improvement in the detail of the dressings, and no doubt suitable dressings for all requirements will

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ultimately be designed; but this result will be more quickly attained when those interested emphasize their requirements and their objections to the dressings at present supplied. Considerable progress has been made, and great improvement in this direction may be looked for in the near future.

The inconvenient character of some of the sterilised dressings sent out in the first aid boxes has been one of the hindrances to reaping the full effect of the orders requiring their provision. Even when the required sterilised dressings have been supplied, the use of rolls of unsterilised lint or gauze, generally not too clean, has been continued, partly owing to the ease with which a dressing of a convenient size can be cut off and applied. Inability to appreciate the value of a sterilised dressing and the possibility of applying such a dressing satisfactorily in a factory, due to want of training in its use, has also retarded progress.

A course of instruction in first aid on somewhat new lines, arranged by and under the supervision of Dr. T. W. Woodhead, of the Technical College, Huddersfield, has been successfully commenced in that town. The course is divided into two parts, elementary and advanced. The former is limited to instruction in the use and application of the first aid dressing and such treatment as can be carried out in the workroom or at the first aid box. The advanced course deals with first aid generally, and as the syllabus is approved by the St. John Ambulance Association, those taking the full course are qualified to enter for the examinations of the association. A feature of this course, in so important a centre for the manufacture of dyes, is the attention paid to gassing accidents.

It is not generally realised that wounds, which require treatment other than the application of a sterilised dressing, are not of a nature that can be successfully dealt with in the workroom, but need to be sent on to the ambulance room, hospital, or doctor, for the more complicated forms of treatment. In such cases, however, the immediate application of a sterilised dressing from the first aid box lessens the risk of infection of the wound while the worker is on his way to the ambulance room, hospital, or doctor, and the first aid box continues to be a valuable addition even where an ambulance room is provided in the works. The washing of wounds, which is lightly undertaken by many imperfectly trained persons, often with hands far from clean, is in itself a minor surgical operation requiring technical skill and training, if the injured person is not to be subjected to added and unnecessary risk. For this reason, the treatment of minor injuries recommended does not include washing the wound; and the removal of dirt is limited to applying iodine solution to the wound, which is generally all-sufficient for cases such as it is contemplated will be treated at the first aid box.

Where there is no ambulance room, many firms have provided additional equipment in the form of splints, tourniquet and the like for one of the first aid boxes for use in an emergency, until the injured person can be removed elsewhere. In one factory a well equipped first aid dressing station, the size of a telephone cabinet, with stretcher, chair and other additional equipment has been provided; such arrangements are useful and are recommended in similar circumstances.

The equipment for first aid boxes in the Welfare Order dealing with dyeing and tanning by a solution of bichromate of potassium includes, in addition to sterilised dressings, collodion and waterproof plaster. It has been found in several instances that the plaster supplied has not been of this nature. It is very important that effective plaster, viz., plaster waterproofed on the outside, should be provided in order to prevent the solution saturating the dressing

and in this way attacking the injured part.

An ambulance room is required in factories employing 500 or more persons, which come within the scope of the First Aid and Ambulance Order. This of itself emphasizes the intention of the orders that only minor injuries should be treated at the first aid box, as it is considered that the number of more severe cases which will occur when 500 persons are employed will be sufficient to warrant the provision of such a room, instead of sending such cases elsewhere for treatment.

The suitability of the ambulance rooms provided in the factories has been found to vary very considerably, many of those recently built leaving little to be desired. In one engineering works two large rooms communicating with one another, one for men and one for women, have been built. A rest room next to, and communicating with, the woman's ambulance room, as well as a men's waiting room is also provided. Each ambulance room is lighted on one side with ordinary casement windows, and on the other side large plate glass windows are fitted above the doors and occupy the greater part of the wall space to the ceiling; the light thus provided is excellent. The floors are of terazzo over cement and the walls and ceiling of parian cement covered with washable enamel; all corners are rounded and the woodwork white enamelled. Each ambulance room is fully equipped with an electric instrument steriliser, cabinet, dressing wagon, screen, table, chair and couch, a surgeon's sink and a lavatory basin of good design, the supply pipes to these fittings being enclosed. All woodwork is white enamelled.

Many ambulance rooms have been converted from rooms previously used for other purposes, and, although not equal to the ambulance room described above, provide in many instances good accommodation. In some, however, the lighting and ventilation is defective; in others the wooden floors and wooden panelling of the walls are difficult to keep clean; consequently, the result is not always entirely satisfactory. There is no doubt that for quiet and cleanliness the ambulance room should be well separated from the workrooms. Where the sanitary conveniences are not near the ambulance room, a special water-closet is necessary. In some cases this has been provided by cutting off a corner of the ambulance room by a partition — in a few instances not extending to the ceiling. In neither case is the arrangement satisfactory, the latter being particularly objectionable. The convenience should be built outside the ambulance room, and, wherever possible, with an intervening ventilated space.

The person in charge of the ambulance room should have considerable experience and training in the treatment of wounds. The scope of treatment given in the ambulance room must vary with the standard of training and qualifications of the person in charge, and this has generally been found to be the case. A fully trained nurse is able to deal with the more serious cases as well as with the redressings of old cases which are beyond the capacity of a person with certificates of first aid only. The training for these certificates lays stress upon the importance of referring all cases treated to a person with greater knowledge. In some instances persons have been found in charge of the ambulance room who by their training are only qualified to render very simple first aid, but who, nevertheless, attempt other treatment which they are incompetent to carry out correctly. The term "nurse" is used very widely and includes many with little or no training in dealing with wounds. Mental or maternity training, home nursing, or even less, appears to qualify for the title of "nurse" as soon as the uniform is put on. Fully trained nurses are now employed in many factories, and the advantages of their services not

only in the ambulance room but also in the general supervision of first aid through the factory have been apparent.

The difficulty of appointing fully trained nurses to take charge of ambulance rooms in smaller works is a real one, but this has been overcome in Sheffield by several firms, whose works are adjacent, joining together and employing a highly trained nurse who visits the ambulance rooms at appointed hours, redresses old cases, and sees all cases referred to her by the first aid attendants. The scheme so far works well and is one that is worthy of commendation under similar circumstances.

The orders have, on the whole, been appreciated; objections to them have been chiefly against the introduction of the first aid boxes in factories where an ambulance room is provided. This is almost entirely due to failure to understand the purpose for which the boxes are intended, viz., treatment of minor injuries, and protection against infection in the case of serious accidents requiring treatment in the ambulance room. Unauthorised interference with and pilfering of the contents of the boxes has also added to the difficulty. This interference is in a large measure due to a lack of interest in the first aid, and want of organisation of this work in the factory. Generally speaking, the interest taken by the workers in first aid is considerable, and only requires stimulation. The interests of employers and employees are identical where first aid is concerned, and the absence of any organisation in nearly all the factories visited, which it is believed would enormously increase the benefits of the first aid provisions, is to be regretted. With the formation of safety first committees, a way should be found to remedy this defect by the formation of a sub-committee to deal with all matters concerning first aid, to undertake arrangements in connection with the training of persons in the application of a first aid dressing, and to appoint the persons responsible for each first aid box. Each of these persons, with more advanced training, might also act as the captain of the squad trained to render the very simple first aid in his department of the factory. The sub-committee would also deal with any representations made regarding the suitability of the position or contents of the boxes and would also take cognisance of pilfering and all other matters concerning first aid. To advise the sub-committee, the services of a medical man in touch with the works — the certifying surgeon, for instance — might most usefully be retained. Reports of all accidents, however trifling, should be submitted to this sub-committee, who would refer cases of abnormal incidence of accidents in particular departments or occurring on particular machines to the full committee. The information so obtained should prove of very practical value and should emphasize the importance of keeping records, with full particulars, of all cases.

These suggestions indicate the lines upon which an organisation of first aid in factories might be brought about, and without which it is felt the benefits of the first aid provisions will never be fully obtained.

MERCURIAL POISONING IN THE MANUFACTURE OF CLINICAL THERMOMETERS*

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THIS paper describes the processes of thermometer manufacture as seen in individual shops, together with hazardous conditions that have been found; cases of mercurial poisoning that have occurred in the shops are described; and finally preventive measures that have been recommended for safeguarding the health of the workers are given.

Clinical thermometers are made from rounded strips of glass with a central bore — strips cut to the required length. Each of these strips or stems is opened out to form the blister by means of a gas flame and air pump, and the bulb is then blown. The next process is that of filling the bulb with mercury heated by a Bunsen flame; then follows testing by standard comparisons. The tops of the stems are next sealed, the blister is contracted, the heads are rounded off, and the thermometer is engraved.

In one of the factories that I recently surveyed and in which a worker had been affected with mercurial poisoning, I found the following conditions: All windows were closed. Over the places where the bulbs were being filled with heated mercury, volatilization of the mercury took place. Hoods had been placed here, but served no purpose, as they were neither enclosed nor connected with the outer air, and therefore did not prevent inhalation by the workers of the mercurial vapor. During the process of testing, mercury was brushed off into the workroom and upon the work benches and floors where it lodged in cracks and crevices. Under the influence of the warm and moist atmosphere of the room, the spilled mercury was volatilized and inhaled. The heat of the room was caused by a great number of torches consisting of air and gas flames, while the moisture was caused by the heated water used for testing. No provision was made for the reduction of this excessive heat and moisture. The reason given for keeping the windows closed and for the non-connection of the hoods with the outer air was that such air would interfere with the work by deflecting the flames of the torches. These then were the conditions which favored the contraction of mercurial poisoning in this particular factory.

Other hazards, moreover, were noticed in connection with the work of this same establishment — namely, hot and bright flickering flames of the torches affecting the eyes of the workers, hydrofluoric acid irritating respiratory and conjunctival membranes during processes of etching, paint coming in contact with fingers during the filling in of the markings and graduations after engraving, illuminating gas leakage from fixtures and pipes, and glass dust scattering into the air from broken stems on the floors and tables. Washing facilities consisted of cold running water only. Street clothes were hung in the shop and were exposed to the dusts and vapors.

The following case describes the effect upon one of the employees of exposure to the above-mentioned conditions:

CASE 1.—The patient, who is 42 years of age, has been a thermometer maker for the past twenty years. He is a married man, non-indulgent in tobacco or in alcohol. His present illness began about one year ago with severe chills and tremors, pain in

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the gums, and occasional feeling of dizziness coming on after the tremor.

Physical examination shows a rather obese man with fairly good nutrition. His face, lips, and mucous membrane are pale and there are a few papules on the skin of his face and limbs. His eyes react to light and accommodation; his ears and nose are negative; his tongue is coated and shows a few blebs. His teeth and gums show pyorrhea, the gums being spongy, bleeding and painful to the touch. There is a slight salivation. On projection of the tongue a very fine tremor is noticed and articulation is poor. The tonsils are enlarged; the pharynx is coated and intensely red; the neck shows no tenderness nor rigidity.

The shape and size of the patient's chest are good though he is very obese; small respiratory movements are visible. The lungs are negative to inspection, percussion, and auscultation. The heart sequence is fair, the rate rapid, and the sounds weakly transmitted. The apex point is not visible nor palpable, but is faintly heard at times. The radial pulse is weak and small.

The patient's abdomen shows no tenderness nor rigidity, no palpable growth nor tumor. Percussion of the stomach gives tympanitic resonance elicited very high up towards the left chest, a region of marked obesity and flabbiness. The liver dullness extends very high into right chest; the spleen is not palpable. The kidneys, genitals, and lymph glands are negative.

The patient's extremities were fairly well developed but show a marked exaggerated tremor in the feet and hands. This tremor is an intentional one; when the patient gets up the entire body shakes, the tremor being so marked in the legs and trunk that the patient is unable to remain standing. The patella reflexes are exaggerated. When the patient is lying down the tremor disappears. A similar tremor is also present in the tongue, preventing the articulation of words. The hands and fingers are likewise affected by tremor.

The patient, while at the hospital where I examined him, showed a maximum temperature of 100° and a minimum of 99°. His pulse was 104 maximum, 76 minimum. Respiration was 30 maximum, 18 minimum. Mercury was found chemically in the urine. Urinary examination also showed many granular, epithelial, mucous, and pus casts.

In another factory, recently visited, the work was performed in two buildings. In one building, the following work was done: cutting of the glass, making the sample, making the blister, joining the bulb, filling the bulb with mercury, contracting the blister, regulating the mercury, and sealing the tops of the stems. In the other building the engraving was done in the following stages: The bulbs were dipped into the testing tank, marked with a knife, dipped in beeswax, blotted to smooth the wax, and passed through scaling and pentagraph machines. They were then dipped in paraffine, put on a rack, dipped in wood alcohol, and then into hydrofluoric acid. The bulbs were then etched, dipped into water, and laid in kerosene oil until the wax was melted. They were then taken out, placed in water, then blackened, and finally tested and certified.

In the first building there existed conditions most favorable for the contraction of mercurial poisoning. During the process of filling the bulbs, the mercury was boiled by gas and air flames and, the stems being opened, the mercurial vapor escaped. No means were taken to prevent the inhalation of this vapor by the workers. No mercury receptacles were provided to take care of the mercury that was spilled on the benches though this spilled mercury volatilizes at ordinary temperatures. Facilities for washing with hot water and soap were entirely lacking. Street clothes, hung in the shop, absorbed the vapor.

Case 2. — The proprietor of the above factory, a man of 48 years of age, had never observed any precautions though he had been engaged in making thermometers from the age of 14. In the course of his work he contracted mercurial poisoning and was seen by me at the hospital. Though his tremors started eighteen years ago, it was not until two years ago that they became so marked that he was unable to work. He has had an impediment in his speech for the past ten months, and finds it difficult to talk without great effort. His gait, however, is not staggering. On account of his tremor, he is unable to feed himself. The tremor is an intentional one — that is, there is none present when the patient is not doing anything. He has occasional very severe headaches. He smokes excessively, using fifteen to eighteen cigars a day, and is moderately indulgent in drink.

He has neither pains, numbness, tingling in the arms, hands nor legs, and no formication is present.

The patient gives a past history of pertussis, measles, parotitis, tonsillitis, and pharyngitis. His family history is negative. On account of nocturia he sleeps poorly.

Physical examination brings out the following facts: The patient's speech is peculiar and scanning; his pupils react to light and accommodation; there is slight nystagmus and no strabismus; his nose is negative. His teeth are poorly kept, with many missing, and his pharynx is congested. His ears show no tophi, no discharge nor mastoid tenderness.

The patient's chest is well developed; both sides are symmetrical and used equally during respiration. Palpation gives equal tactile fremitus anteriorly and posteriorly. The percussion note is normal over the entire chest. On auscultation the breath sounds are found to be normal; posteriorly moist râles are present here and there. Inspection of the heart is negative; palpation shows the apex beat in the fifth interspace; percussion is negative. On auscultation, the sounds indicate fair muscular quality, and are distinct. The rate is normal; there is no murmur and no arrhythmia. Examination of the patient's abdomen gives negative findings. Examination of reflexes shows increased knee jerks, cremasteric and abdominal reflexes present, Babinski absent, and ankle clonus present. There is no paralysis present in any part of the body. Sensations of temperature, touch, and pain, are normal over the entire body. The patient is markedly irritable and excited in conversation.

Laboratory examination of the urine gives the following findings: acid reaction, specific gravity of 1021, yellow color, a trace of albumin, no sugar, an occasional hyaline cast, few leucocytes, and occasional epithelial cells. The urine is negative for mercury. Colonic irrigation for mercury is positive. Examination of the stool for mercury gives a positive reaction. The Wassermann is negative. Chemical examination of the blood is negative; hemoglobin, 80 per cent.; white blood cells, 14,400. The red cells show no abnormalities. Examination of blood smears shows 65 per cent. polymorphonuclear leucocytes and 35 per cent. lymphocytes.

On seeing the patient a month after I had examined him at the hospital, I asked him how he felt. He said, "I feel like a thermometer." When I asked him what he meant, he answered, "Why in winter, I feel myself contracting. All my skin gets cold. In summer, I feel myself expanding, perspire perfusely. But I feel better in summer and much relieved." This can be explained by the fact that in winter the mercury is not eliminated through his skin. In summer, the heat vaporizes the mercury and ameliorates his condition.

Preventive Measures

In order to safeguard the health of the worker, it is necessary to consider, first, the worker himself, and second, his environment. A man who takes up the manufacture of thermometers should consult his physician, have a thorough examination, and from time to time have a re-examination made in order to detect any variation from normal health. From the description of the cases above, it will be seen that the habits, family histories and personal histories of the patients were investigated and complete physical and laboratory examinations made. Such examinations should be made from time to time and the housing hygiene and home environment noted. Then a complete survey of factory conditions should be made in order to discover the source of any poison.

Proper personal precautions in the factory require that the worker should prevent as far as possible any contact of the skin of his hands or body with mercury or other impurities. He should wear separate work clothes, which should be washed once weekly, and his street clothes should be protected from any contact with the poisons of the factory. He should thoroughly wash his hands and other exposed parts of the body with warm water and soap before eating, and should dry them with his own individual towel. No food should be eaten in the workshop. Lockers and individual towels and proper washing facilities, including running hot and cold water, brushes and soap, should be provided. The worker should guard against inhaling impure air in which may lurk dust, gases, and vapors

generated during the processes in the manufacture of thermometers. Proper provisions should be made for the control and removal of these impurities and for the reduction of the excessive heat, by means of hoods, exhausts, natural and mechanical ventilation. A supply of fresh, clean, cool air should be furnished. Faulty machinery, pipes, and sanitary equipment should be corrected. Especially is it necessary for the worker to be careful in the handling of glass and mercury, refraining from throwing either on the floors or benches, or from brushing off the mercury into the room. Enameled iron receptacles for catching mercury should be provided. Tops of benches or tables should be covered with enameled iron with raised borders, so as to prevent the mercury from falling to the floor. Wooden benches and floors are objectionable, as they favor the lodgement of spilled mercury in cracks and crevices. Flames should be placed under properly constructed hoods which will conduct vapors, gases, and heat to the outer air. These hoods should be entirely enclosed, having a sliding glass door in front, with openings for the insertion of the hands and arms of the worker. In this way workers will be completely protected during the process of filling bulbs with mercury.

Co-operation of employer and employees should be obtained to protect the health of workers in this industry, and it is gratifying to state that such co-operation is possible in most instances. Since mercurial poisoning is often slow in manifesting itself, it is frequently necessary to impress its dangers upon those who have apparently not yet been affected by the poison. Educational methods through health department officials, and, finally, enforcement of health codes may be necessary for refractory individuals.

THE HEALTH OF THE SCHOOL TEACHER*

An Analysis of a Series of Physical Examinations of a Group of Normal School Students

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THE attention now being paid to the necessity of arousing a national consciousness concerning matters of health has prompted this paper. Occupational diseases are being studied as never before. The results of the physical examinations of the draftees of the army revealed the fact that we are not, as a nation, physically fit. An aroused sense of the value and means of acquiring and preserving good health has grown out of it all, so that newspaper and magazine articles spread health knowledge broadcast. An inquiry concerning the health of the school teacher, therefore, seems timely.

But little is definitely known concerning the health of the school teacher as influenced by his vocational activities. Among the most recent contributions to the problem is a report made by a commission on the welfare of teachers of the New York State Teachers' Association — a report which summarizes the results obtained from a questionnaire asking information on the general problem and distributed among several hundred teachers of the state. In 1912 Terman published his booklet, *The Teacher's Health*, in which, in addition to his own contributions, he summarizes the results of studies made both in this country and abroad. But with these studies in hand one is unable to infer with assurance that much is known concerning the effects, *per se*, of the labors of the teacher upon his own health. So fundamental a professional activity deserves critical investigation with special reference to any direct occupational effects upon health. For the health of the teacher, even above that of members of almost any other profession, is an asset of more than personal value — it is a social asset of high order. For the teacher, health not only sets bounds for teaching activities, but is also a vital factor in influencing and determining mental attitudes and states, and, further, in radiating a subtle influence on pupils, as a result of which they, in turn, are moved to take on similar mental attitudes and states. A wholesome, healthful teacher is a powerful influence. Any insight, therefore, which may be obtained into the health status of this occupation is worth the effort.

A brief résumé of the salient points of the two studies referred to above will serve as a basis for the discussion to be presented. The report of the Commission on the Welfare of Teachers presents the results obtained from the extensive distribution of a detailed questionnaire, together with the testimony of a group of some ninety-five supervisors covering their observations on elements of health within the groups of teachers under their professional supervision. To the questionnaire, 2,076 replies were received, covering both elementary and high school groups, as well as urban and rural teachers, while the supervisors reported upon 3,730 cases of which 919 were urban and 1,157 rural. It is evident that the investigation covered a fairly cosmopolitan group and that the results, therefore, may be accepted as fairly typical, save that the larger cities were not represented. Furthermore, the replies represented a fairly large range of teaching years

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— 49 per cent., less than six years, to 12 per cent., twenty-one years or over.

From the 2,076 questionnaire cases it appears that:

1. Thirty-one per cent. were not sufficiently vigorous to meet successfully the continuous strain of teaching, while 10 per cent. reported chronic ill health.

2. Thirty and three-tenths per cent. reported health worse at the time of report than when teaching was begun.

3. Seventy-nine and seven-tenths per cent. reported health disorders within the previous five-year period.

4. Eighty-two and eight-tenths per cent. reported health disorders within the previous five-year period or at the time of report, and many testified that their health was as good as at the time of beginning teaching save that they were "more nervous."

5. Forty-one and one-tenth per cent. reported absence from school on account of ill health within the previous two-year period.

6. Sixteen and seven-tenths per cent. of women teachers reported partial impairment of efficiency due to the menstrual function.

In general the health of women was found to be poorer than that of men.

Equally striking were the reports of the supervisors. According to them:

1. More than one-third of their teachers belonged in one of four classes: (a) nervous, (b) irritable, (c) low in vitality or (d) affected with other handicaps. Sixteen and three-tenths per cent. were classed as nervous; 11.4 per cent. as irritable; 9.2 per cent. as low in vitality; 3.4 per cent. as affected with other handicaps. Assuming the same person not to be included in more than one group, this gives a total of 40.3 per cent. with a serious health impediment.

2. Seven and one-tenth per cent. had their efficiency impaired while under supervision.

As a general summary of the results of the investigation the statement is made that "about 30 per cent. of teachers are below the standard of physical health requisite for those entrusted with the instruction of children" while "36.6 per cent. of the group of teachers studied report nervous diseases during the two-year period 1913–1915." On this latter point, a table shows that the longer the term of service, the higher the percentage of those reporting nervous disorders. Of the total reporting, 45.9 per cent. attested to "nervous disorders" of some sort. It is obvious that nervous affections among teachers are of more than common occurrence.

Sixty-six and two-tenths per cent. reported conditions existing in their schools such as to contribute to the development of physical disorders. Of these conditions the following are the more common: excessive demands of school work, effects of poor supervision (unjust, unfair and destructive criticism), handicaps of children due to improper grading according to capacities, inadequate salaries, and inadequate teaching facilities.

Terman, in his discussion of the teacher's health calls attention chiefly: (1) to the physical equipment of those entering the profession, noting that some investigators maintain an adverse selective influence, at the very outset, favoring the entrance of those less able to measure up to the demands of other supposedly more arduous callings; and (2) to the adverse hygienic aspects of the teacher's work, including the conditions under which it is performed. He then summarizes the results of teacher-health surveys both in this country and abroad. From them two facts emerge: *viz.*, that respiratory tract and nervous afflictions obtain in an abnormally large number and percentage of teachers. As proof, he presents reports compiled from the U. S. Census showing that the death rate from tuberculosis among teachers exceeds by

about 5 per cent. that of the occupations of stonecutter and saloon-keeper, which are notoriously unhealthy and favorable to the development of tuberculosis. Likewise, deaths from tuberculosis among female teachers exceed by 19 per cent. deaths from it among females engaged in other occupations.

Terman also shows nervous disabilities to be especially rampant among teachers. The neurasthenic, with "drawn face and knitted brow," with a high-pitched voice, irritable, unstable, troubled with nervous headaches and fixed ideas, is a characterization all too applicable to an abnormally large number of teachers. Probably 20 per cent. is a conservative estimate of the percentage so afflicted, and in this connection Terman makes several relevant observations. According to popular belief the labors of the teacher are constricted between the hours of 9 o'clock in the morning and 4 o'clock in the afternoon, with recesses and a long noon hour to lessen still further the working period. It is popularly believed to be an easy sort of job. In reality, the hours are much extended by out-of-school preparation, extra school-time assistance to backward children, and by extensive social duties in connection with school work. More to the point, according to his contention, is the fact that one hour of room teaching, with its constantly shifting attention is undoubtedly as fatiguing as two hours of work in which constant attention-shifts are not demanded. Overwork in a situation demanding a constant drain upon nervous resources is, undoubtedly, one of the chief elements contributing to the frequent occurrence among teachers of nervous afflictions. The public needs to be educated to these facts before necessary reforms can be effected.

Terman's reviews of studies made abroad are, in the main, corroboratory of those made in this country. It is impossible here, however, to do more than refer to them. As a general conclusion, it appears that teachers in abnormal percentages suffer from respiratory tract and nervous diseases.

The evidence for the belief in a high morbidity rate for teachers seems valid. Explanations for this condition are usually found in two large or general factors: (1) the unhygienic conditions under which the work is done, including the abnormal nervous stresses attendant upon it, and (2) the possible existence of a selection of those types especially disposed toward certain physical and mental lesions.

Attempts to evaluate the influences of teaching, *per se*, have been difficult and inconclusive because of a lack of data concerning the physical equipment of teachers on entering the profession. Teacher-health surveys have been made after the profession has been followed for some time. In order to determine what are the effects of the professional activities upon health it is necessary to have a body of data covering the physical status of a representative body of teachers when they enter the work. This may then be compared with data collected subsequently. It is the purpose of this paper to present (1) the results of a series of physical examinations of a number of normal school students, prospective teachers all, as a typical picture of a group about to enter their professional activities, and (2) to present certain obvious conclusions growing out of the facts thus derived. Elsewhere will be presented the discussion concerning the existence of a selective influence which some writers assert to exist and to be responsible for the presence in the ranks of teachers of abnormal numbers of mentally and physically morbid types. It is my purpose simply to state the conditions as found and to make certain recommendations which seem reasonable in connection with them. It is hoped that an awakened interest in the hygiene of the profession may speedily lead to more extensive and intensive studies of a similar sort, and that

theory and opinion may be replaced by quantitatively determined facts.

Observations made in daily contact with a body of normal school students convinced the writer of a need for at least a cursory physical examination to discover defects of a nature so serious as to interfere with the performance of their school work. In the absence of any previous efforts on the part of the institution to meet this need, and with no funds with which to work, the inertia to be overcome was tremendous. Consent to make the trial, however, was finally secured, and the co-operation of a number of local physicians and dentists was otained, these professional men agreeing to give two hours each day on three days in the week. By alternating, it thus became possible to have medical assistance daily. A trained nurse was furnished by the institution. Students were divided into groups and the task begun.

It seems almost incredible that a group of students, all high school graduates, should so thoroughly misinterpret a plan obviously concerned with their own welfare, yet it is true that at the start a very energetic opposition developed, aided and abetted by some who were certain that physical and moral destruction loomed ahead. The idea of the body as a precious possession, which should be cared for and understood like any other thing of great value, seemed to be entirely absent. Apparently the instruction in the high school and grammar grades had made but little impression of the wholesome and vigorous sort. As the movement gained momentum, however, attitudes changed, and finally a hearty co-operation was secured. In the end it was felt that a real contribution to the lives of these students had been made.

The examinations were not as thorough as it is desirable such examinations should be, yet they served to uncover serious defects. It was found that a team of five workers (a nurse, a dentist, two physicians and the writer) could examine from fourteen to sixteen people in the course of a morning. The nurse and the writer began at 9 o'clock, attending to preliminary points, and thus had the examinees ready for the dentist and physicians who came at 10 o'clock, and finished at 12 o'clock.

The record sheet reproduced below indicates the nature of the examination. All details were entered upon it previous to the physical examination so that when the examinee passed to the physician a preliminary body of facts was ready to expedite his work. He then made his examination, and, if such proved advisable, entered upon the sheet his recommendations. These recommendations served as sources of advice in the follow-up of the cases, and in many instances they proved of very great value.

During the fall of 1916, 320 females and 42 males were thus examined; in 1917, 257 females were studied. The tabulated findings of these two series are presented in Tables 1 and 2. It should be pointed out that the earlier series is by far the less reliable. This is true because the initial results sought for were less clearly defined than they were later. The experiences gained the first year taught many things concerning possibilities and desirable outcomes. As a result, we feel that the later series presents a fairly reliable picture of the physical condition of these prospective teachers. Then, too, in the earlier efforts the services of a dentist were not available. The examinations of the teeth were made by a physician, whose eyes were naturally not skilled to find small defects. As a result only marked cases of dental defects were noted.

Certain facts stand out with especial clearness in these tables. In the first place, a large percentage of females suffer as the result of irregularities in the menstrual function. This is especially noticeable in the later series which shows 26 per cent. so affected. The discrepancy between the two

series is due to the greater care exercised in the determination of the data in the later series. This accounts also for similar discrepancies in other parts of the tables. I have explained above that it was the purpose at the outset to uncover only the conspicuous defects. Later, however, it was found that a more thorough examination might yield useful data for comparative purposes and greater care was thereafter exercised.

NAME..... DATE OF EXAMINATION..... PHYSICIAN.....

Nationality .....Date of Birth.....	FINDINGS OF PHYSICIAN	HISTORY
Std. Height (1) .....Weight	Teeth	.....age.....
Sit. Height (2) .....Breath Cap.	.....	.....age.....
Wt.-Height Coef. .....Vital-Height Coef.	Glands-Cervical.....	.....age.....
Temperature.....Pulse	Tonsils	.....age.....
Hemoglobin .....B. P.	Spine.....	.....age.....
Vaccination Date.....Pos. .....Neg.	Stomach & Digestion	.....age.....
Eyes.....	.....	.....age.....
.....	Heart	Effects.....
Hearing	Lungs	.....
.....	.....	.....
Extremities	Kidneys	.....
.....	Urine-Chem.	Type .....
Posture	Microscopical	.....
.....	Periodicity	Grip, R.....L .....
.....	General.....	Tapping, R.....L .....
Skin and Hair	.....	Form Board .....
.....	.....	.....
		.....

Noteworthy also, in the second place, is the frequency of derangements of the digestive tract. This takes the form of constipation. Undoubtedly this is due to improper habits as regards exercise, but more especially to wrong dieting. Thirty per cent. of the men examined were suffering from digestive derangements, and 32 per cent. of the women in the later series.

A third fact of note concerns the infections of the tonsils. And here again a discrepancy between the two series is easily explained on the basis which has already been indicated. An infection rate of 25 to 44 per cent., however, is indicative of a large amount of future trouble. Derangements of the respiratory tract are few — an average of 1.7 per cent. This does not corroborate Terman's contention that respiratory tract diseases are of all others most likely to be found in teachers. But, if the present data are reliable, and if it were to be found that respiratory tract diseases do exist in unusual numbers among actual teaching individuals, then the conclusion might well be reached that the increase is due primarily to factors in the environment of the school. There are evidences that this is true. Dublin, for example, shows that influenza exhibits a higher incidence among teachers than among other occupational groups of a similar sort. His data on the whole are not

determining ideals of health and physical perfection!

Such, then, were the conditions found. Obviously the presence of physical defects — for the most part remediable — in such large numbers, is very strongly suggestive that not all of the disorders of teachers are the results of unhygienic environmental factors, save in so far as such factors serve to bring pre-existing defects into prominence. Many such conditions as are shown to exist eventuate in lesions of a far more serious sort. For example, constipation, defective vision and irregular periods are a fitting prelude for later nervousness, which — possibly under the stresses of the schoolroom — may develop into aggravated forms of mental trouble. It is not our contention that teaching offers no factors or conditions which are sufficient to develop lesions of a serious sort, but rather to call attention to the fact that not all serious disorders can be attributed to such factors. Not a few of the conditions which have been described above are remediable, were there only some agency capable of uncovering the defects and then of seeing to it that suitable prophylactic measures are employed. This might well be undertaken by the state inasmuch as the quality and even the quantity of service later received from the teacher by the state is determined, in part at least, by the teacher's physical excellence. No better investment for the general public good could be made.

It is impossible to infer from our observations whether there is a selective activity drawing into teaching types physically below the general health level. Our data serve only as indicative of the equipment of a typical group of potential teachers. Subsequent investigation, however, may throw further light on the matter. Making such comparisons as are possible for us to make, we feel that there is no evidence that persons below par physically are drawn especially into teaching.

Our data in general suggest an imperative need for a thorough physical examination of those contemplating entering the teaching profession. This need exists not only for the sake of the candidates themselves — great as their need is — but also on account of the relation which is to exist later between these teachers and their pupils. Such examinations are advisable also as a wise provision for later effective service. It is the belief of the writer that candidates possessed of low physical health should be debarred from entering the classroom as teachers. He recognizes the difficulties of setting a standard and obtaining a just and fair adherence to it, but this difficulty does not detract at all from the fact that such a standard is desirable. He is of the belief also that a vigorous and well-developed plan should be perfected to develop in the minds of teachers the value of a good body and the means of attaining it. This cannot be done by the mere reading of books; it must be associated with some general movement which finds its significance in the great needs of human life. Health must be recognized as a part of the necessary equipment of a worthy and effective life spent in the training of youth.

The facts presented in this paper seem to warrant the following recommendations:

1. That thorough physical examinations, at state expense, be given candidates for teaching; that these be followed by suitable measures to remedy defects wherever possible; and that similar examinations be given at stated periods thereafter in order to discover initial lesions.

2. That conditions in the schools which may lead to physical or mental disorders be definitely determined and, in so far as possible, corrected. The immediate problem concerns itself not merely with the question as to how great is the extent of physical and mental maladjustment, but also with the fact that at present the physical and mental equipment of a large percentage of

teachers is not *sufficient*. Efficiency demands the reduction of the adverse conditions to an absolute minimum.

3. A standard of physical excellence is desirable for those entering teaching. The setting of such a standard must be left to future studies.

General Summary

1. Our data yield no evidence that there is a selective activity drawing into the profession teaching types predisposed to either physical or mental weaknesses. Discussion concerning this phase of the problem will be published elsewhere.

2. On the other hand, prospective teachers as represented by normal school students display physical defects — for the most part, remediable — which may readily lead to the types of health disabilities found among teachers. For example, irregular periods, constipation, tonsillar infections, eye strain, and other defects, would seem to account for later nervousness which, under the stress of teaching, may possibly eventuate in neurasthenia and nervous exhaustion.

3. Suitable data are not now available to determine possible morbid influences of teaching. Our data are presented as a typical picture of a group of entrants upon the work of the profession. Later studies should reveal the true effects of teaching itself, including, of course, the effects of the environmental factors, both physical and psychical.

BIBLIOGRAPHY

Dublin, L. I.: Physical Disability of New York City School Teachers. School and Society, Oct. 7, and 14, 1916.

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NOTICES

AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS

(Meeting to be held in conjunction with the Health Service Section of the National Safety Council in Milwaukee, Tuesday and Wednesday, September 28 and 29, 1920.)

PROGRAM

SEPTEMBER 28, 1920 — TUESDAY A.M.

Dr W. Irving Clark, Jr., *Chairman*

Dr. C. C. Burlingame — "Doctor and Patient *vs.* Employer and Employee."
Dr. Harry E. Mock — "Preventive Medicine in Industry."
Dr. Carey P. McCord, *Chairman* — "Committee Report on Occupational Diseases."
Dr. D. B. Lowe — "The Mortality and Morbidity of the Factory Worker."

TABLE 1. — RESULTS OF PHYSICAL EXAMINATIONS OF NORMAL SCHOOL STUDENTS, 1916 SERIES

320 Females

Irregular Periods	Digestive Tract	Spine	Glands	Respiratory Tract	Teeth	Heart	Urinary Tract	Eyes	Ears	Extremities
52	constipation, 34 chr. appendicitis, 6 gastritis, 1	scoliosis, 21 weak back, 2	bad tonsils, 79 with adenoids, 2	bronchitis, 2 chronic catarrh, 3 tuberculous, 1	very bad and probable cause of disease, 17 with pyorrhea, 2	13	involving bladder, 7	needing glasses to be fitted, 57	hearing affected, 17	flatfoot, 78
16%	13%	7%	25%	1.8%	6%	4%	2%	17.7%	5.5%	24%

42 Males

	constipation, 7 indigestion, 3 gastritis, 2 chr. appendicitis, 1	scoliosis, 1	diseased tonsils, 10 with adenoids, 1		(not examined)	1		needing glasses, 7		flatfoot, 2
	30%	2%	26%			2%		16%		4.7%

TABLE 2. — RESULTS OF PHYSICAL EXAMINATIONS OF NORMAL SCHOOL STUDENTS, 1917 SERIES

257 Females

Irregular Periods	Digestive Tract	Spine	Glands	Respiratory Tract	Teeth	Heart	Urinary Tract	Eyes	Ears	Extremities
68	constipation, 50 indigestion, 16 chr. appendicitis, 2 constipation and chr. appendicitis, 5	scoliosis, 22 congenital scoliosis, 1 weak, 1	enlarged cervicals, 19 enlarged thyroid, 33 badly diseased tonsils, 57 enlarged tonsils, 34 adenoids, 3	bronchitis, 2 spitting blood, 1 probably tuberculous, 2	requiring dental care, 87 pyorrhea, 16	endocarditis, 5	bladder, 5 urine examination advised, 17	compound myopic astig., 30 compound hyperopic astig., 1 myopia, 12 eye strain, 16 refit needed, 12 color blind, 1	one or both ears affected, 21	flatfoot, 97
26%	28%	9.5%	44% *	1.9%	40%	1.9%	8.5%	28%	8%	38%

* Double infections reckoned as one.

comparable with ours since they are compiled only from reported cases of disease so serious as to compel absence from school. In general, however, they corroborate our findings.

Only three cases of tuberculosis of the lungs were found, and one of these was doubtful. This would give but 0.5 per cent., which is surprisingly low considering the fact that the great bulk of these subjects were between the ages of 18 and 21 years, ages at which the expectancy for the disease is very much greater. If, then, the rate of tuberculosis is very much greater among active teachers, there must be factors in the teaching environment to bring about such an increase. If, however, the per cent. of tonsillar infections were added to that of genuine respiratory tract diseases, as is sometimes done, there might then appear to be a remarkable instance of an unusually high degree of infection. Obviously such procedure is unwarranted. It is evident that the teacher enters the school with a very small likelihood of carrying tuberculosis or other respiratory tract derangements with her. The untoward conditions under which her work is done may well account for subsequent high morbidity due to such afflictions.

In our later series, 38 per cent. were found to be in need of more or less immediate dental treatment. By this is meant that conditions existed which were thought to be serious enough to influence health. These conditions ranged from an extensive array of badly decayed teeth to aggravated cases of pyorrhea. In not a few instances dental attention had been impossible on account of financial inability to provide for it. In a few instances it was a matter of carelessness.

Diseases of the heart and urinary tract were few. Several cases of endocarditis were found, only two of which were of a serious nature. These seemed to be the result of aggravated tonsillar infections. The urinary tract presented few instances of disease, what trouble there was consisting chiefly of frequent urination. Several urine tests were made for sugar and albumin but with negative results. It must be admitted, however, that information on these points was not as easily obtained, under the circumstances, as on the others. It is likely that the data are distorted in this respect.

A surprisingly large number of cases of eye defects were discovered. In many cases these defects were so extreme as to interfere very greatly with school work. These pupils were, nevertheless, attempting to do their daily tasks with these handicaps. Headaches and nervousness were not associated with possible eye defects. Here again, remedial measures were sometimes not taken on account of a lack of the necessary funds. Obviously some provision should be made for meeting the needs of such cases.

Noteworthy also is the very large percentage of cases of flatfoot. Observations were made on this point not only for the purpose of determining the number so afflicted, but also in order to advise against the use of fashionable high-heeled shoes. It is not a certainty that all such defects are due to high heels but undoubtedly many are. The stout, large boned, and short-digited type of person appears to be naturally flatfooted. The same appears to be true also of the opposite extreme, represented by the very long and narrow foot in which the arch is likely to be low. Of the well-developed foot, strongly arched, and fully able to bear the body weight, one finds but few cases — among the females at any rate. The most discouraging part of the situation lay in the fact that these young women cared less about their feet than they did about being in style. This is an unfortunate commentary upon the mental set as well as upon the influence of previous years of school and home life in

determining ideals of health and physical perfection!

Such, then, were the conditions found. Obviously the presence of physical defects — for the most part remediable — in such large numbers, is very strongly suggestive that not all of the disorders of teachers are the results of unhygienic environmental factors, save in so far as such factors serve to bring pre-existing defects into prominence. Many such conditions as are shown to exist eventuate in lesions of a far more serious sort. For example, constipation, defective vision and irregular periods are a fitting prelude for later nervousness, which — possibly under the stresses of the schoolroom — may develop into aggravated forms of mental trouble. It is not our contention that teaching offers no factors or conditions which are sufficient to develop lesions of a serious sort, but rather to call attention to the fact that not all serious disorders can be attributed to such factors. Not a few of the conditions which have been described above are remediable, were there only some agency capable of uncovering the defects and then of seeing to it that suitable prophylactic measures are employed. This might well be undertaken by the state inasmuch as the quality and even the quantity of service later received from the teacher by the state is determined, in part at least, by the teacher's physical excellence. No better investment for the general public good could be made.

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SEPTEMBER 29, 1920 — WEDNESDAY A. M.

Dr. Otto P. Geier, *Chairman*

Chairman's Address — "The Future of Industrial Medicine and Surgery."
Dr. John J. Moorehead — "Fractures Incident to Occupation."
Dr. Wm. O'Neill Sherman — "Industrial Surgery."

SEPTEMBER 29, 1920 — WEDNESDAY P. M.

Dr. W. Irving Clark, Jr., *Chairman*

Dr. A. W. Colcord — "Physical Examination of Employees."
Dr. W. A. Sawyer — Subject not reported.
Dr. H. M. Brewer — "The Dental Dispensary — Its Importance, Its Help and Its Cost."

INSTITUTE OF INDUSTRIAL NURSING

An Institute of Industrial Nursing under the auspices of the New Haven Visiting Nurse Association will be held September 20 to 30, inclusive, at 35 Elm Street, New Haven, Conn.

An intensive and interesting program has been prepared and the following experts in Public Health will give lectures:

C.-E. A. Winslow — Industrial Hygiene.
Florence Swift Wright — Industrial Nursing.
C. C. Burlingame — Hospital Management and Record Keeping.
George Blumer — Industrial Diseases.
R. M. Thompson — Industrial Relations.
Mary P. Wheeler — Social Problems.
H. C. Link — Industrial Psychology.
Maria Nelson — Nutrition and Budgets.

Only graduate registered nurses interested in industrial work are eligible — preferably nurses with public health experience.

The fee is $5.00, payable at time of registration, which must be not later than September 12.

INDUSTRIAL CLINIC

The Health Department of Norton Company, New Bond Street, Worcester, Mass., holds a monthly industrial clinic, at which cases of industrial accident and disease are presented and discussed. Three clinics have already been held, the first upon "Infectious Arthritis in Industry," the second upon "Fractures in Industry," and the third upon "Cardiac Disease in Industry."

The clinics last from 5 until 6 o'clock in the afternoon. Any industrial or other physicians and surgeons interested are cordially invited to attend. If those interested will write, their names will be placed on the mailing list and they will receive notification of the exact date and time of each clinic.